NINETEENTH ANNUAL METAL CONGRESS ISSUE

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THE IRON AGE

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THE FORGING AND CASTING CORPORATION

FERNDALE, MICHIGAN

October 14, 1937

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P.S.- You can see samples of FCC products and useful literature at Booth No. G-95 at the National Metal Congress and Exposition.

Helping the metals industry steer its course

1918
1937

ASM

With the opening of NATIONAL METAL CONGRESS in Atlantic City next Monday, the AMERICAN SOCIETY *for* METALS enters on its twentieth year of service to the association's membership and the entire metals industry.

A voluntary not-for-profit group such as AMERICAN SOCIETY *for* METALS cannot continue in existence for nineteen years unless, at all times, it gives liberally to its members in exchange for the time, energy and money they give it. The fact that "A. S. M." today enjoys the largest membership in its history is adequate testimony to the increasing service it is rendering each successive year.

AMERICAN SOCIETY FOR METALS

A DIGEST OF A. S. M. ACTIVITIES

ACTIVE CHAPTERS in 50 industrial centers meet at regular intervals to hear selected speakers discuss technical subjects, hold round table meetings or make plant inspection trips. Many Chapters sponsor comprehensive courses in metallurgy.

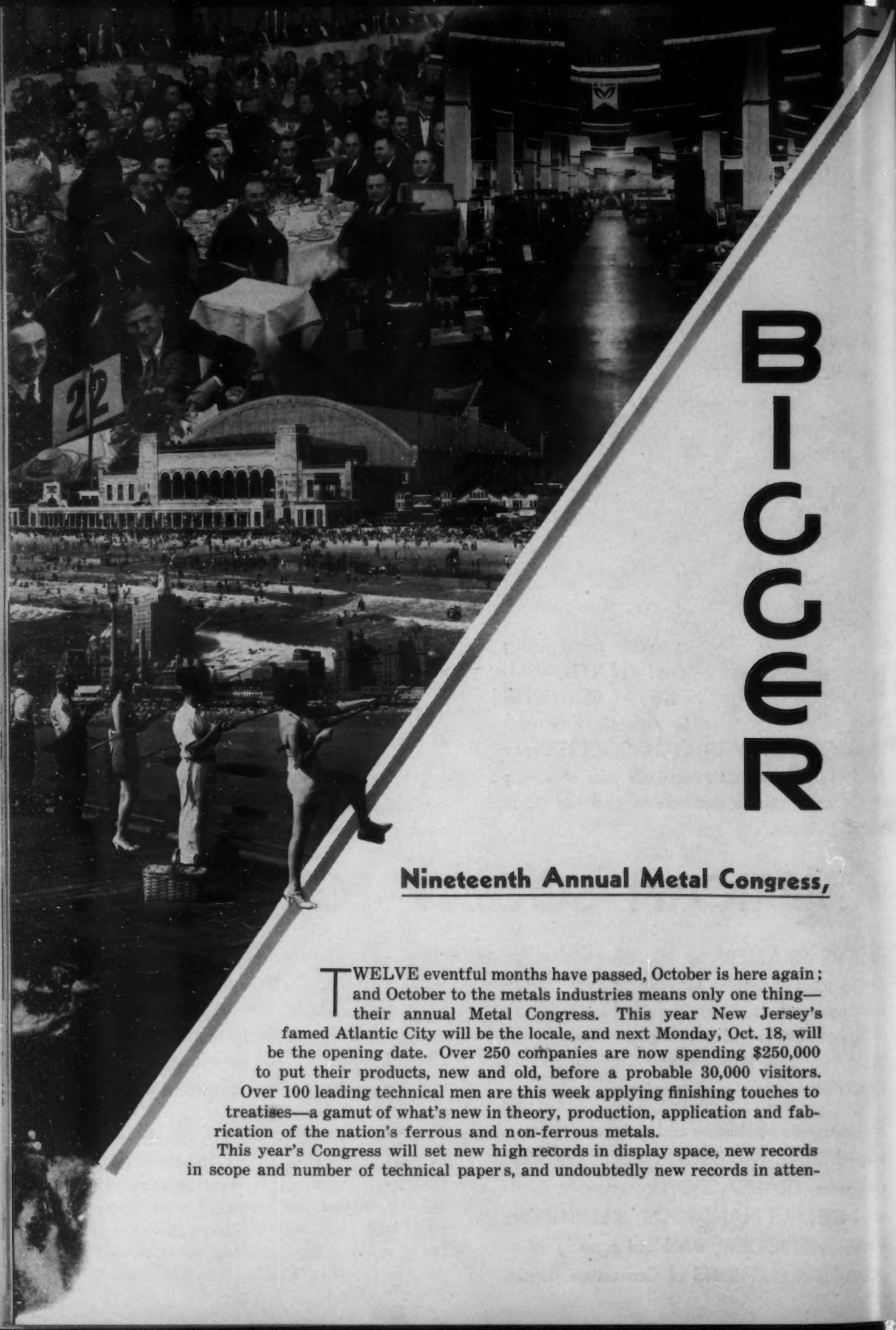
The association publishes and distributes to members—METAL PROGRESS, a monthly technical magazine; TRANSACTIONS, a scientific quarterly; METALS HANDBOOK, a biennial data book; THE REVIEW, a tabloid monthly newspaper; and PREPRINTS of Convention papers.

The association produces, in connection with National Metal Congress, NATIONAL METAL EXPOSITION, the greatest annual event in the metal industry.

Other functions include educational work, book and library services and employment service.

●

Certain of the 50 active chapters have a few vacancies available to men actively engaged in the metals industry. A letter on company letterhead, stating the nature of your work, will bring you complete information as to the benefits of membership. *Address American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.*

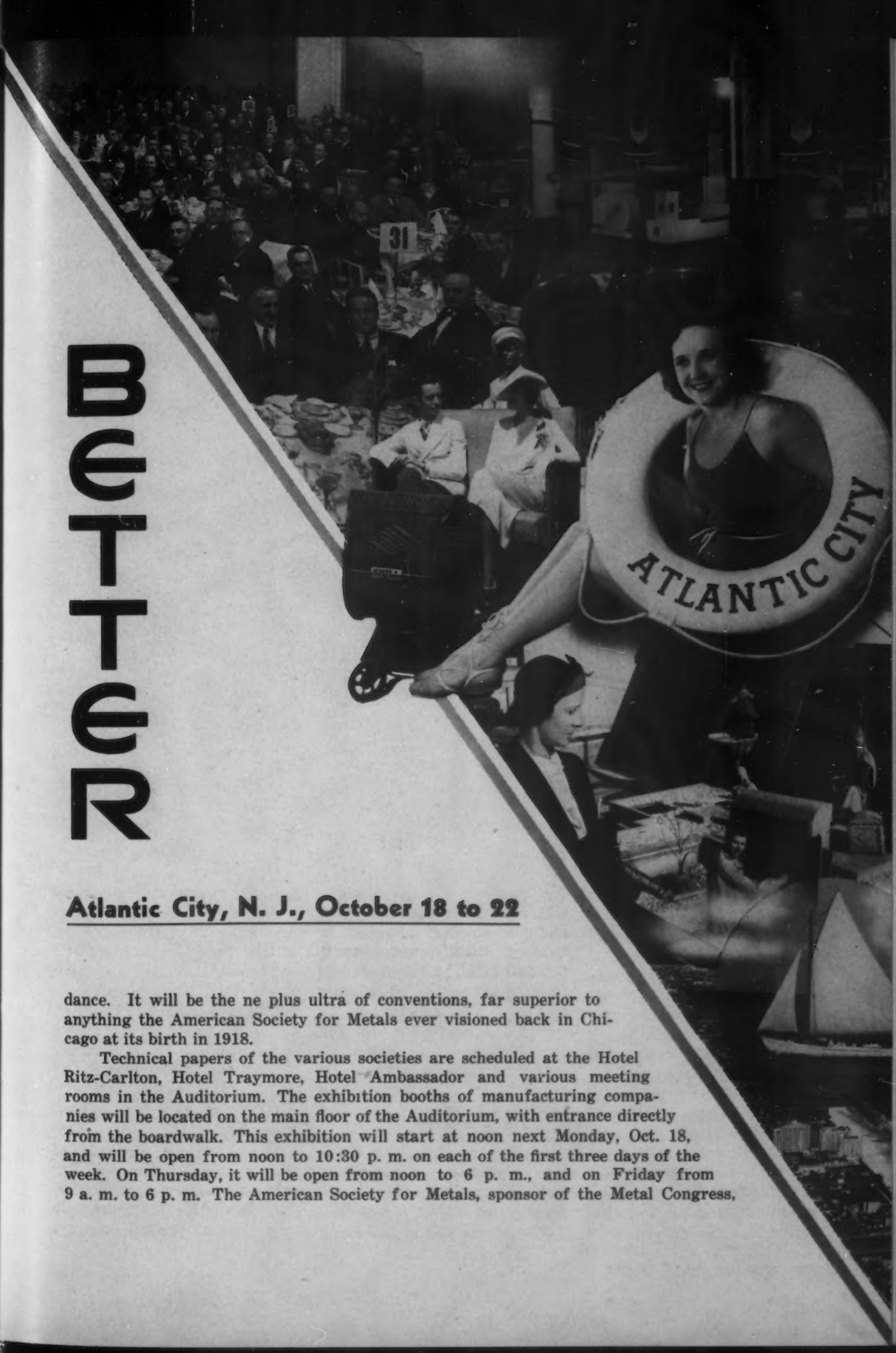


BIGGER

Nineteenth Annual Metal Congress,

TWELVE eventful months have passed, October is here again; and October to the metals industries means only one thing—their annual Metal Congress. This year New Jersey's famed Atlantic City will be the locale, and next Monday, Oct. 18, will be the opening date. Over 250 companies are now spending $250,000 to put their products, new and old, before a probable 30,000 visitors. Over 100 leading technical men are this week applying finishing touches to treatises—a gamut of what's new in theory, production, application and fabrication of the nation's ferrous and non-ferrous metals.

This year's Congress will set new high records in display space, new records in scope and number of technical papers, and undoubtedly new records in atten-



BETTER

Atlantic City, N. J., October 18 to 22

dance. It will be the ne plus ultra of conventions, far superior to anything the American Society for Metals ever visioned back in Chicago at its birth in 1918.

Technical papers of the various societies are scheduled at the Hotel Ritz-Carlton, Hotel Traymore, Hotel Ambassador and various meeting rooms in the Auditorium. The exhibition booths of manufacturing companies will be located on the main floor of the Auditorium, with entrance directly from the boardwalk. This exhibition will start at noon next Monday, Oct. 18, and will be open from noon to 10:30 p. m. on each of the first three days of the week. On Thursday, it will be open from noon to 6 p. m., and on Friday from 9 a. m. to 6 p. m. The American Society for Metals, sponsor of the Metal Congress,

E. C. BAIN, President, American Society for Metals.

G. B. WATERHOUSE, Vice-President, American Society for Metals.

has a technical program which features a two-day symposium on carburizing and 30 other papers on a variety of metal subjects. Two lecture courses will occupy the hours of late afternoon and early evening—one is a comprehensive five-lecture series on "Steel Making," by Earnshaw Cook, and the other consists of three lectures on "Metallographic Technic," by J. R. Vilella.

The American Society of Mechanical Engineers, one of the cooperating groups, has a one-day session planned, which will be presented jointly with the American Welding Society, and will feature the mechanics of welding and the relation of design to welding. This should prove to be a very interesting and valuable discourse on this important subject.

A well balanced technical program has been developed by the American Welding Society, with sessions on both industrial and fundamental research in welding. Other aspects of welding now much in the news, and forming the subject of separate sessions, are fabrication by welding, shipbuilding, welding on railroads, and welding of alloy steels. The Fundamental Research Committee will again meet to discuss work done and plan future projects.

Monday morning, the Welding Society will be addressed by A. E. Gibson, retiring president; the Samuel Wylie Miller Memorial Medal will be presented for "meritorious achievement contributing conspicuously to the advancement of welding and cutting"; the Lincoln Medal will be presented for, "the best paper of the year in the *Welding Journal;* and president-elect P. G. Lang, Jr., will outline activities for the coming year. A dinner dance and entertainment for all members is scheduled for Thursday evening, at 7 p. m., at the Hotel Traymore.

The American Institute of Mining and Metallurgical Engineers, another cooperating society in the Metal Congress, is scheduling all its fall meetings

W. H. EISENMAN, Secretary, American Society for Metals.

W. P. WOODSIDE, Treasurer, American Society for Metals.

at Atlantic City, and will have a total of about 20 papers over the five-day period.

The headquarters of the A.I.M.E. Metals Division will be at the Ritz-Carlton Hotel, where registration, technical sessions, science lectures, Metals Division dinner, and all A.I.M.E. committee meetings will be held. The round table discussion on the physics of metals, in which the A.I.M.E. is joining with the several other societies as designated in the program on page 52, will be held Monday night in the Exposition Auditorium.

The meetings in the early part of the week, namely, the round table discussion on Monday evening, the technical session on Tuesday morning and the science lecture on Tuesday afternoon, will comprise a sequence of meetings devoted to the physics of metals. The round table will cover discussions of stress-strain relationships of unilateral, bilateral and three dimensional stresses, true stress strain curves, and the transmission of energy through crystalline media. The technical session on physics of metals will have papers on the theory of diffusion, a study of the flow of metals with particular reference to elongation at the yield point, and a paper on the meaning of impact tests. The science lecture, concluding this sequence on the physics of metals, will be presented by Professor A. F. Benton, of the University of Virginia, speaking on the subject, "The Behavior of Gases at Metal Surfaces." Other technical sessions will be devoted to general metallurgy, metallography and open-hearth steel practice.

A luncheon meeting of the executive committee of the Iron and Steel Division will be held on Wednesday, Oct. 20; and the luncheon meeting of the executive committee of the Institute of Metals Division and of the Open Hearth Executive Committee will be held on Thursday, Oct. 21.

The annual fall dinner of the Metals Division will be on Wednesday evening.

Correlated Technical Program

MONDAY, OCT. 18

10 A.M.

The Process of Dry Cyaniding, R. J. Cowan and J. T. Bryce, A.S.M., Ambassador Hotel, Renaissance Room.

10:40 A.M.

The Mechanism of Steel Hardening and Tempering as Indicated by Coercive Force Measurements, R. S. Dean and C. Y. Clayton, A.S.M., Ambassador Hotel, Renaissance Room.

11:20 A.M.

Effect of Tempering Quenched Hypereutectoid Steels on the Physical Properties and Microstructure, C. R. Austin and B. S. Norris, A.S.M., Ambassador Hotel, Renaissance Room.

2 P.M.

Effect of Carbon on the Hardenability of High Purity Iron-Carbon Alloys, T. G. Digges, A.S.M., Auditorium Ball Room.

A Note on Rapid Photomicrography, W. Mutchler and H. W. Willier, A.S.M., Room B, Auditorium.

Spot Welding Characteristics of Some Copper Base Alloys, by D. K. Crampton and J. J. Vreeland; *Survey of Low-Alloy Steels as to Weldability*, by J. H. Critchett; *Physical Properties and Corrosion Resistance of Nickel-Iron Alloys Formed in the Welding of Nickel-Clad Steel*, by J. H. Deppeler, W. G. Thiesinger and F. G. Flocke; and *X-ray Methods of Studying Stress Relief in Welds*, by J. T. Norton, A.W.S., Hotel Traymore.

2:40 P.M.

Precipitation-Hardening of Cobalt Steel: A New Tool Material, R. H. Harrington, A.S.M., Auditorium Ball Room.

The Effect of Grain Size on the Oxidation of a Low-Carbon Steel, C. A. Siebert and Clair Upthegrove, A.S.M., Room B, Auditorium.

3:20 P.M.

Quantitative Hardenability, J. L. Burns, T. L. Moore and R. S. Archer, A.S.M., Auditorium Ball Room.

Electromagnetic Measurements and Steel Structures Correlated, Carl Kinsley, A.S.M., Room B, Auditorium.

4:30 P.M.

Open-Hearth Steel Making, educational lecture by Earnshaw Cook, A.S.M., Auditorium Ball Room.

8 P.M.

Metallographic Technique, educational lecture by J. R. Vilella; A.S.M. Auditorium Ball Room. Physics of metals round table discussion, Room B, Auditorium, A.S.M., A.I.M.E., American Society for Testing Materials and American Institute of Physics; *True Stress Strain Curves for Single Crystals, True Stress Strain Curves for Polycrystalline Materials, Internal Dissipation of Energy in Metals for Small Cyclic Strains.*

TUESDAY, OCT. 19

9:30 A.M.

Fatigue Tests of Butt Welds in Plates, by W. M. Wilson; *Proximity Effect in Welding Problems*, by E. Bennett; and *The Heat Effect in Welding*, by W. H. Bruckner; A.W.S., Hotel Traymore.

10 A.M.

The Rupture Strength of Steels at Elevated Temperatures, A. W. White and C. L. Clark; A.S.M., Renaissance Room, Hotel Ambassador.

ARTHUR F. BENTON

Who will present the A.I.M.E. science lecture, his subject being, "The Behavior of Gases at Metal Surfaces."

Physics of Metals, A.I.M.E., Trellis Room, Hotel Ritz-Carlton. *A Theory of Diffusion in Solids*, by John E. Dorn and Oscar E. Harder; *Some Fundamentals Concerning Impact Testing*, by Earl B. Smith; and *The Problem of the Temperature Coefficient of Tensile Creep Rate*, by J. J. Kanter.

10:40 A.M.

The Heat Treatment of High Speed Steels in Salt Baths, by Axel Hultgren; A.S.M., Renaissance Room, Hotel Ambassador.

11:20 A.M.

A New Aplication for the Short-Time High Temperature Tensile Test, by C. L. Clark, A. E. White and C. J. Guarnieri; A.S.M., Renaissance Room, Hotel Ambassador.

2 P.M.

Austenitic Grain Size of Eutectoid Steel, by Harry Tobin and R. L. Kenyon; A.S.M., Auditorium Ball Room.

Science Lecture, Metals Division of the A.I.M.E., Trellis Room, Hotel Ritz-Carlton; *The Behavior of Gases at Metal Surfaces*, by Arthur F. Benton.

Fundamental research in welding. A.W.S., Hotel Traymore. *Welded Girders with Inclined Stiffeners*, by Cyril D. Jensen; *Welding of Copper*, by A. P. Young; *Static and Impact Tensile Properties of Stainless Steel Welds at Ordinary and Low Temperatures*, by O. H. Henry; *Effect of Welded Clip Angles on Beam-Column Connections*, by Inge Lyse, and *High-Speed Motion Pictures of Flame Cutting*, by H. R. Bullock.

Resistance Welding Fabrication, by J. M. Cooper; *Developments in Large Welded Structures*, by C. C. Brinton; and *Recent Developments in Fusion Welding*, by C. W. Obert; A.W.S. and A.S.M.E., Hotel Traymore.

2:40 P.M.

Some Factors Influencing Austenitic Grain Size in High Purity Steels, by G. Derge, A. R. Kommel, and R. F. Mehl; A.S.M., Auditorium Ball Room

3:20 P.M.

Relation of Pre-Treatment of Steels to Austenitic Grain Growth, by J. E. Dorn and O. E. Harder; A.S.M., Auditorium Ball Room.

4:30 P.M.

Educational lecture, A.S.M., Auditorium Ball Room; *Open-Hearth Steel Making*, by Earnshaw Cook.

8 P.M.

Educational lecture, AS.M., Auditorium Ball Room; *Metallographic Technique*, by J. R. Vilella.

WEDNESDAY, OCT. 20

9:30 A.M.

Fabrication session, A.W.S., Hotel Traymore; *Carbon Arc Welding in Automotive Work*, by William Richards; *Automatic Resistance Welding*, by Harry Landstrom; and *Welding —An Aid in Dam Construction.*

10 A.M.

Annual meeting of the A.S.M., Renaissance Room, Hotel Ambassador; The 1937 Edward De Mille Campbell Memorial Lecture, presented by W. P. Sykes, of General Electric Co.

2 P.M.

Diffusion of Carbon from Steel Into Iron, by L. C. Grimshaw; *Investigations on Lead-Magnesium Alloys for the Prevention of Lead Poisoning in Waterfowl*, by R. L. Dowdell and R. G. Green; and *The Effect of Chromium on the Grain Growth of Brass*, by Bruce W. Gonser and Carlos M. Heath; A.I.M.E., Trellis Room, Hotel Ritz-Carlton.

The Effect of Mass Upon the Mechanical Properties of Cast Steel, by C. W. Briggs and R. A. Gezelius; A.S.M., Auditorium Ball Room.

2:40 P.M.

The Fatigue Resistance of Steel as Affected by Some Cleaning Methods, by J. H. Frye, Jr. and G. L. Kehl; A.S.M., Auditorium Ball Room.

3:20 P.M.

Influence of Heat Treatment on Creep of Carbon-Molybdenum and Chromium-Molybdenum-Silicon Steel, by R. F. Miller, R. F. Campbell, R. H. Aborn and E. C. Wright; A.S.M., Auditorium Ball Room.

4:30 P.M.

Educational lecture, A.S.M. Auditorium Ball Room; *Open-Hearth Steel Making*, by Earnshaw Cook.

A.S.M.—A.I.M.E.—A.W.S.—A.S.M.E.

7 P.M.

Annual dinner, Institute of Metals and Iron and Steel Divisions, A.I.M.E., joined by Machine Shop Practice Division, A.S.M.E.; Hotel Ritz-Carlton. Dinner speaker, Harvey N. Davis, president of Stevens Institute of Technology; subject: *The Place of the Engineer in Modern Life.*

8 P.M.

Educational lecture, A.S.M., Auditorium Ball Room; *Metallographic Technique,* by J. R. Vilella.

THURSDAY, OCT. 21

9:30 A.M.

Symposium on alloy steels, A.W.S., Hotel Traymore; *Low-Alloy Steels,* by G. S. Mikhalapov and A. B. Kinzel; *High-Alloy Steels,* by J. C. Holmberg and R. Vincent.

10 A.M.

Iron and Steel Division, A.I.M.E., Trellis Room, Hotel Ritz-Carlton; *Effect of Silicon on Steels for High-temperature Service,* by H. D. Newell; *Notes on Microstructures and Hardness of Alloys Consisting Essentially of Iron, Chromium and Silicon,* by A. G. H. Anderson and Eric R. Jette; and *An X-ray Study of the Effects of Adding Carbon, Nickel, or Manganese to Some Ternary Iron-Chromium-Silicon Alloys,* by Eric R. Jette and A. G. H. Anderson.

Symposium on Carburizing, A.S.M., Renaissance Room, Hotel Ambassador; *A Review of Some Fundamentals of Carburizing,* by M. A. Grossmann.

The Initial Stages of Graphitization, by H. A. Schwartz and M. K. Barnett; A.S.M., Rainbow Room, Hotel Ambassador.

Institute of Metals Division, A.I.M.E., Main Dining Room, Hotel Ritz-Carlton; *Age Hardening of Aluminum Alloys, III—Double Hardness Peaks,* by W. L. Fink and D. W. Smith; *Use of Tellurium in Copper-Base Alloys,* by H. L. Burghoff and D. E. Lawson; and *Sulphur, Selenium and Tellurium in Copper-Base Alloys,* by Cyril S. Smith.

10:40 A.M.

Symposium on carburizing, A.S.M., Renaissance Room, Hotel Ambassador; *A Theoretical Discussion of the Action of Solid Carburizing Agents,* by H. W. McQuaid.

An X-ray Study of the Ar_3 and Ac_3 Points of Iron and Iron-Nickel Alloys, by Sidney D. Smith; A.S.M., Rainbow Room, Hotel Ambassador.

11:20 A.M.

Symposium on carburizing, A.S.M., Renaissance Room, Hotel Ambassador; *Gaseous Media for Carburizing,* by G. T. Williams.

Graphitization in High Purity Iron-Carbon Alloys, by Cyril Wells; A.S.M., Rainbow Room, Hotel Ambassador.

2 P.M.

Open-hearth steel practice, A.I.M.E., Trellis Room, Hotel Ritz-Carlton; *Extensive Control Features Open Hearth Practice at Lackawanna,* by P. F. Kinyoun; *Basic Open Hearth Slag Control by the Use of the Viscosimeter,* by W. J. Reagan; *Combined Carbon; The Controlling Factor in Quality of Basic Pig Iron,* by Ralph H. Sweetser; and *Progress*

HARVEY N. DAVIS

Who will address the A.I.M.E. on, "The Place of the Engineer in Modern Life."

Report on the Use of Venturi Ports in Open-Hearth Furnaces, by George L. Danforth, Jr.

Shipbuilding session, A.W.S., Hotel Traymore; *Welding in Building Tanker Vessels,* by T. M. Jackson; *Assembly Plant for the Welding of Barges,* by George F. Wolfe; *Phases of Testing in the Welding of Naval Vessels,* by Lieutenant Commander W. P. Roop; and *All-Welded Steel Tankers,* by A. C. Leigh.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Factors Governing Selection of Type of Carburized Case,* by A. L. Boegehold and C. J. Tobin.

Solubility of Copper in the Grain-Boundary Material of a Solid Solution of Copper in Zinc, by G. R. Dean and W. P. Davey; A.S.M., Room B, Auditorium.

2:30 P.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Furnace Atmospheres and Decarburization,* by J. A. Webber.

2:40 P.M.

The Rate of Austenite Transformation in Cast Iron, by D. W. Murphy, W. P. Wood and D. Girardi; A.S.M., Room B, Auditorium.

3 P.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Steels Used in the Carburizing Process,* by O. W. McMullan.

3:20 P.M.

The Effects of Columbium and Other Addition Agents on Low-Chromium Steels, Russell Franks; A.S.M., Room B, Auditorium.

3:30 P.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *A Hardenability Test for Carburizing Steel,* by W. E. Jominy and A. L. Boegehold.

4:30 P.M.

Educational lecture, Auditorium; *Open-Hearth Steel Making,* by Earnshaw Cook.

FRIDAY, OCT. 22

9:30 A.M.

Railroad session, A.W.S., Hotel Traymore; *Building Up Locomotive Driving Boxes,* by I. T. Bennett; *Machine Gas Cutting in Railroad Work,* by H. Bass; and *Welding of Railroad Rolling Stock,* by V. R. Willoughby.

10 A.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Production Carburizing,* by E. F. Davis.

Effects of Longitudinal Scratches on Valve Spring Wire, by F. P. Zimmerli, W. P. Wood and G. D. Wilson; A.S.M., Room B, Auditorium.

10:40 A.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *A Study of Commercial Carburizing Containers,* by R. W. Roush and A. C. Dames.

Recovery of Cold-Worked Nickel on Annealing, by Erich Fetz; A.S.M., Room B, Auditorium.

11:20 A.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *The Physical and Chemical Characteristics of Carburizing Compounds and Their Handling in Production,* by S. L. Widrig.

Metal Coloring, by C. B. F. Young; A.S.M., Room B, Auditorium.

2 P.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Commercial Gas Carburizing,* by L. D. Gable and E. S. Rowland.

A Study of Deoxidation Type Inclusions in Alloy Steels, by W. A. Hare and Gilbert Soler; A.S.M., Room B, Auditorium.

2:40 P.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Light Cases by Gas Carburizing,* by V. T. Malcolm.

Some Problems in the Production of Low-Carbon Sheets in Non-Continuous Mills, by M. L. Samuels and Alfred Boyles; Room B, Auditorium.

3:20 P.M.

Symposium on carburizing, A.S.M., Auditorium Ball Room; *Liquid Bath Carburizing,* by B. B. Beckwith.

Relation of Size of Spheroids in Tool Steel to its Machineability and to Holding Edge of Cutter, by D. E. Roda; A.S.M., Room B, Auditorium.

4:30 P.M.

Educational Lecture, A.S.M., Auditorium Ball Room; *Open-Hearth Steel Making,* by Earnshaw Cook.

10 CU + 18 CR + 72 FE, etc.

A MOST unusual alloy structure, and hardly one to incite expectations of toughness or stainlessness. The golden-colored stringers and spots are a copper-rich phase, the remainder an iron-rich phase. Many of the dark spots probably are copper-rich also, but have failed to show any color at 1600 diameters.

= {DIGBY'S CYPRITIC ALLOY, AN ENTIRELY NEW SPECIES OF THE GENUS STAINLESS STEEL

o o o

By T. W. LIPPERT
Metallurgical Editor, The Iron Age

o o o

IT'S downright metallurgical heresy to keep pouring an additional phase into steel — to deliberately add a new element in quantities far greater than the base metal can assimilate on cooling. But this heresy has been committed, and therewith a high corrosion-resistant steel of widely variant character has resulted, all of which is well worth detailed examination.

But let's bow to orderly sequence in the examination and go back a decade to a small commercial laboratory in Aldwych, London, England, and, in retrospect, look over the shoulder of a consulting engineer while he indulges in some metallurgical obstetrics. The engineer, yclept Digby, is experimenting with an iron-free acid-resisting alloy, made up of nickel, chromium and molybdenum. True enough the alloy is very acid resisting, but it is equally true that costs are exorbitant.

Perhaps an entirely new alloy may offer acid-resistance at low cost. Perhaps, just perhaps, it might be worth the try to go the whole hog and step far out of metallurgical bounds; so Mr. Digby dumps 15 per cent of copper into an iron-chromium alloy, and he gets just about what you might expect—a hell of a mixture erratically immiscible in the laboratory furnace. When cast the two-constituent steel solidifies like mother's raisin pudding — an iron-rich alloy shot through with gobs of copper-rich alloy, the latter often as big as golf balls. To see in this mixture so heavily enceinte with copper the birth of a new breed of commercial alloys requires a particular kind of dogged courage—but Mr. Digby has it, and he works for ten years to justify himself. The years

were devoted primarily to charting the boundaries of the strange ternary alloy, to making the immiscible steel miscible, to making the unforgeable steel forgeable, to making the excessively unmachineable material highly machineable, and to laying down at least the groundwork of a heat-treating cycle to secure the flexibility inherent in the copper-chromium-iron analysis. Then, bulwarked by a reliable, albeit spotty, laboratory history, the new stainless steel has been fed out to English steel mills and fabricators, and sufficient commercial data have accumulated during the past year and a half to indicate that the industry has in this new Digby cypritic[1] alloy a brand-new type of stainless steel possessing worthy possibilities.

All the physical data so far established by reliable European laboratories suggest that the very unconventional chrome-copper stainless steel is in certain respects able to approach conventional alloys as an engineering metal; also, meriting consideration is the insistence of the inventor that cost reductions will accrue from the substitution of cheaper copper for dearer nickel, and the (claimed) ability of several grades of chrome-copper steel (with various heat treatments) to match the greatly varied physical properties of numerous conventional stainless alloys now marketed.

What the physical properties are, how the steel is made and what results have been secured in service to date, all will be treated in the following paragraphs in as much detail as existing information permits. Of course, the chromium-copper stainless steels are still in their infancy, and many a metallurgical ramification needs yet to be explored to completely establish their correct commercial position; but in this, the first public mention of Digby cypritic steel, the author will take some liberties to bridge gaps, in order to present a coordinated account of what is undoubtedly a very unique and, perhaps, valuable metallurgical development.

Monypenny Came Close

Copper, one of the first known and one of the cheapest of metals, has had a hazardous history as an alloying agent in steel. A century ago adventitious copper often ran up to 0.3 to 0.4 per cent in iron and steels, but early producers were hardly (if at all) cognizant of its presence. Then, prior to the turn of the century, copper acquired a most evil reputation, and usually was first cursed if a heat went haywire, particularly if it cracked or went to pieces in the hot mill. But, shortly thereafter, copper as a minor alloying element in mild steel was championed by a few brave metallurgists, such as D. M. Buck in America, J. E. Stead in England and Pierre Breuil in France, with the result that many mills proceeded to turn out thousands of tons of copper-bearing (about 0.20 Cu) steel shapes and sheets, having as a most predominant characteristic a worthwhile increment in corrosion resistance. And, within the past few years, there has been a flood of low-alloy high-strength constructional steels (Cor-Ten, Mayari, Hi-steel, RDS, Yoloy, etc.) all containing copper, from 0.30 to 1.50 per cent. Thus, the obvious conclusion is that the role of copper in ordinary steel is commendable, that is commendable when confined to less than 2 per cent.

In the so-called stainless steels, copper has been (and is) on occasion deliberately added up to a few per cent, and in most cases has acquitted itself with credit. In 1924, Saklatwalla[2] claimed that 0.5 to 1.5 per cent copper in stainless steels (particularly with C=0.15) increases the non-corrodible properties and decreases high-temperature oxidation, and in the same year Strauss and Talley[3] added 1.08 per cent copper to a 22.44 Cr-0.24 C stainless steel, and hesitatingly suggested that after quenching from a high temperature the impact value was increased. Several years later Mochel[4] added 1 per cent copper to medium-chromium stainless iron (10 to 18 per cent Cr, 0.12 C), and reported the resistance to salt water or to salt spray was increased and there was no decrease in mechanical properties. Later, Saklatwalla and Demmler[5] alloyed 2 per cent copper to a stainless iron containing

FIG. 1—(Below) An early attempt to forge cypritic steel showed this result—the alloy has broken up along the copper-rich phase boundaries. (Above) A successful heating and forging cycle was educed, and the steel forged with ease.

[1] The term "cyprite" designating the copper-rich phase was obviously inspired by England's isle of Cyprus, which in the bronze age supplied all the copper used by Egypt and Greece.

[2] B. D. Saklatwalla, THE IRON AGE, 1924, pp. 1209-1213.

[3] J. Strauss and J. W. Talley, Proceedings of American Society for Testing Materials, v. 24, part 2, 1924, pp. 217-258.

[4] N. L. Mochel, Transactions of American Society for Steel Treating, v. 10, 1926, pp. 353-394.

[5] B. D. Saklatwalla and A. W. Demmler, Transactions of American Society of Steel Treating, v. 15, 1929, pp. 36-48.

14 per cent chromium, the result being an appreciable increase in strength and hardness; and only a few years ago DeVries[6] was favorably impressed with a "new rustless iron alloy" containing about 16 per cent chromium, 1 per cent silicon, 1 per cent copper, 0.40 manganese and not over 0.10 carbon.

All these ventures enhanced copper's reputation, and rightfully so; but note particularly that all the work (also other experiments not reported here) has been confined to low copper contents. Experimentation with copper up to 10 per cent (as in the new Digby alloys) has been practically nil, and to the author's knowledge only one man, Monypenny[7] ventured to introduce large quantities of copper into a stainless steel. In one instance Monypenny went up to 9.85 per cent copper (15.7 Cr, 0.16 C), but had little to say about the result other than the copper had an influence similar to nickel, but contradictorily did not lead to the production of austenite, when present in fairly large amounts.

It's not to be wondered that thoughts of high-copper analyses have been horrendous; for even tentative ventures over 3 or 4 per cent have supposedly disclosed detrimental trends of such definiteness that a 10 per cent alloying addition (to mild steel or ordinary stainless) could result in little more than some appalling mélange hardly suitable for casting into sash weights.[8] That the cold solubility of iron in copper is very low, of the order of a few tenths of 1 per cent, is an experimental fact, which naturally indicates that much larger additions of copper could result in nothing much more than the precipitation out of nearly pure copper in a solidified steel, with possible disastrous results on mechanical properties and working characteristics. Furthermore, although the solubility of chromium in copper is none too definitely known, it is extremely low none-the-less. Thus, for a combination of the three, iron-chromium-copper, any possibility of getting a decent alloy at very high concentrations has been so remote that experimenters have not even bothered to investigate a solubility diagram for this region.

W. P. DIGBY,

who has brought the "cypritic" stainless steels up to their present stage of development. Mr. Digby has had some 30 years practice as a consultant in Westminster, England, particularly on problems dealing with the handling and corrosion of metals, the strength of steel in its relation to the duty required, investigations of mechanical vibration and designing of power and pumping equipment. He is a member of the (British) Institution of Electrical Engineers, Institution of Mechanical Engineers and Association of Consulting Engineers. Intimately associated with Mr. Digby in his work on cypritic steels is his brother, Everard, who received his early technical training at London University, and has more recently been interested in many steel and allied developments in England.

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Another factor discouraging ventures into high copper has been the prediction that a ferritic structure would ensue, whereas an austenitic structure with its attendant ductility has been considered the sine qua non of high grade steels.[9] And still another negating factor has been the suspicion that high copper contents would result in so-called hot-shortness[10] which in turn practically obviates rolling or forging of the metal.

Now consider the Digby cypritic stainless steel, which contains about 10 per cent copper and about

[6] R. P. DeVries, Metals and Alloys, v. 3, 1932, pp. 49-51.

[7] J. H. G. Monypenny, "Stainless Iron and Steel," John Wiley & Sons, Inc., 2nd Ed., 1931, p. 575.

[8] Of course, these statements don't apply to alloys having large nickel contents, as a nickel addition serves to carry large quantities of copper. For example, consider the very useful austenitic Ni-Resist cast iron, the original form of which contains 13 to 15 Ni, 5 to 7 Cu and about 2 Cr.

[9] Ductile metals, i.e., copper, aluminum, nickel, etc., all have a face-centered (austenitic) atomic structure, and steels and other alloys of excellent ductility have a similar crystal pattern. There is no hidebound rule that the two phenomena are inexorably correlated, but no distinct exception has been found. These new cypritic steels, although martensitic (body-centered structure), are none-the-less fairly ductile and easily worked, but not to the extent of a true austenitic steel.

[10] A common term which merely means brittleness. Its origin probably lies in the use of shortening in pastry to make it crisp. Hot or red-short metal is brittle at rolling or forging temperatures. A metal also may be cold-short, i.e., brittle at room temperature.

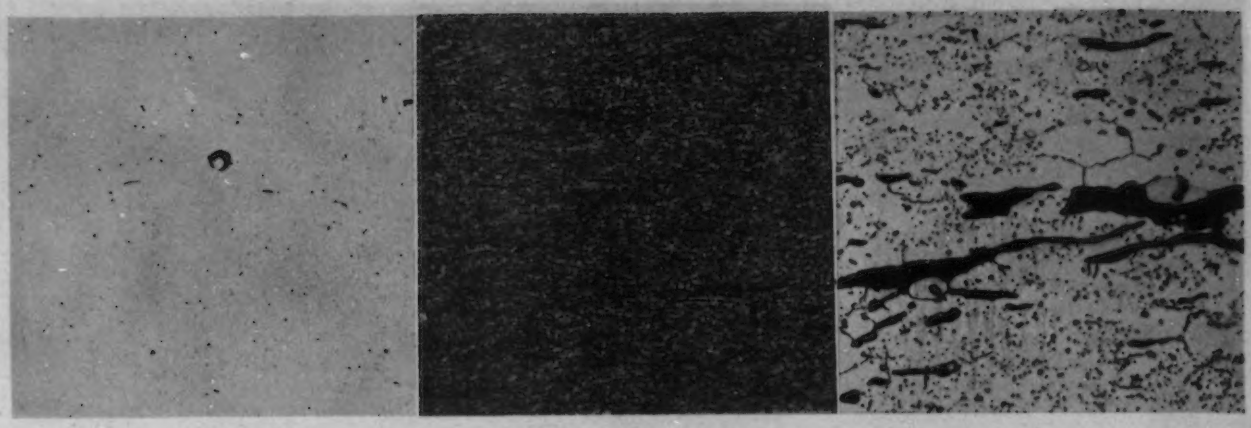

FIG. 2—Microscopic examination of hot-rolled and annealed cypritic steel (13.19 Cr and 9.58 Cu). (Left) A typical view as regards non-metallic inclusions, unetched and at 100 diameters. Some of the inclusions are two-phase (probably the chromium-iron oxide-sulphide type), but the number of inclusions is not excessive and their distribution is fairly uniform. (Middle) The same sample etched with ferric chloride and at 100 diameters. The copper-rich stringers appear black in the photograph but show a brilliant copper color under visual examination. (Right) Same view, but at 1000 diameters. The cyprite phase is black, appearing as stringers and fine particles scattered throughout the matrix.

15 per cent chromium, and note its many characteristics in opposition to the foregoing denigrations.

Characteristics

FIRST: The cypritic steels are not red short in the practical sense, at least in small-size ingots—they can be forged or rolled with ease, once radically different working techniques and heat treatments have been educed and verified. That the heat treatment is of major importance is well illustrated by the two forged samples shown in Fig. 1. Even a casual glance at the structure of cypritic alloy would indicate that it should be very difficult to hot-work. The cyprite phase probably melts at around 1995 deg. F.—and opposed to this is the fact that certain of the conventional chromium-steel analyses are difficult to roll at such a low temperature. Even at, say, 1900 deg. the cyprite phase probably is plastic, and for this reason the hot-reduction of cypritic steel at the exceptionally low temperature of 1900 deg. would seemingly be about as satisfactory as rolling a sponge full of water. Temperatures even as high as 1900 deg. are not necessary, however, according to the inventor, as proved by the numerous small ingots successfully rolled here and abroad. But whether very large ingots shot through high-speed mills in the typical American quantity-production manner can be reduced with equal facility is still a moot question.

SECOND: There is no segrega-

TABLE II

Mechanical Properties of Chromium-Iron[1], Chromium-Nickel-Iron[2], and Chromium-Copper-Iron[3] Stainless Steel Alloys

Properties at Room Temperature	12 Per Cent Chromium, Annealed	12 Per Cent Chromium, Quenched and Drawn at 1100 Deg. F.	17 Per Cent Chromium, Annealed	17 Per Cent Chromium, Cold Worked (Wire)	18 Per Cent Chromium and 8 Per Cent Nickel, Annealed	18 Per Cent Chromium and 8 Per Cent Nickel, Cold Worked (Wire)	Digby Cypritic Steel, 18 Per Cent Chromium and 8 to 10 Per Cent Copper[4], Air Cooled and Tempered	Digby Cypritic Steel, 15 Per Cent Chromium and 8 to 10 Per Cent Copper[5], Air Cooled and Tempered
Ultimate strength, 10^3 lb. per sq. in...	65	125	75	100 to 190	80 to 90	105 to 300	95 to 105	130 to 180
Yield point, 10^3 lb. per sq. in.....	35	100	40	.....	40	60 to 250	72	110 to 120
Elongation in 2 in., per cent.....	35	20	27	.....	60	.....	29	21 to 22
Reduction in area, per cent.....	65	60	55	.....	70	.....	57	50 to 55
Izod impact, ft.-lb.....	80	.....	8 to 25	.....	75 to 100	.....	66	50 to 120
Brinell hardness number.....	140	230	175	185 to 270	135 to 165	170 to 460	250 to 260[6]	300 to 315[6]

[1 and 2] Values taken from "Book of Stainless Steels," edited by E. E. Thum.

[3] Test data by one of England's largest steel mills.

[4] C = 0.09, Mn = 0.36 to 0.40, Si = 0.25 to 0.27, S = 0.019, P = 0.013 to 0.016.

[5] C = 0.05 to 0.08, Mn = 0.28 to 0.35, Si = 0.23 to 0.42, S = 0.018 to 0.019, P = 0.014 to 0.015.

[6] Average of values: Lower figure for air cooled and tempered, higher figure for water quenched and tempered; certain specimens in higher chrome grade showed a hardness near 230, and in lower chrome grade near 430.

tion of pure copper, but rather a precipitation of stringers of "cyprite," a high-copper constituent (certainly containing not more than a few per cent chromium and iron in solid solution), which rather than being detrimental is credited by the inventor as imparting valuable properties to the steel. These cyprite stringers are shown in the photomicrographs on page 54 and in Figs. 2 and 3. Dr. Bradley, in England, has taken X-ray powder photographs of cypritic steels, and all have shown structures largely of the body-centered cubic type, as would be expected. The chromium-iron lattice is therefore like that of α iron, in which chromium and some copper atoms go into solution. Dr. Bradley reported no trace of a second constituent in the 15 chromium-10 copper alloy, but the 18 chromium-8 copper alloys both show traces of a second superimposed pattern of a face-centered cubic constituent, which is undoubtedly the copper rich phase. A photograph taken of a slowly cooled conventional specimen, containing 18 chromium-8 nickel also shows the body-centered cubic pattern. Thus, the copper-chromium cypritic steels (as mentioned in footnote 9), are essentially of the straight-chromium ferritic type and not like conventional austenitic chromium-nickel steels.

THIRD: Corrosion-resisting characteristics are not impaired to any extent by the copper addition, but rather are apparently actually improved in certain instances. The inventor has stated that the copper-rich constituent (cyprite), has been produced independently in an induction furnace, and itself shows an extremely high corrosion resistance. Furthermore, in some solutions, the electromotive force between the copper-rich phase and the surrounding iron-rich phase has been tested and found to be very low.

FIG. 4—It looks tough. This hot-rolled chrome-copper bar, magnified two times, has been sawed half-way through and broken the remainder of the way. Notice the fibrous structure and the way the metal tears along the cyprite cords, presenting a fracture somewhat like wrought iron.

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FOURTH: Mechanical properties are surprisingly satisfactory, according to the information so far at hand. Being non-austenitic, little intergranular corrosion after welding would be expected. Under carefully controlled production conditions, the presence of copper in the stainless steel seems to impart a greater strength and impact value without any loss of high corrosion resistance given to it by chromium. In one of the two main varieties of the cypritic steel, the tendency to form a tough adherent dendritic structure without brittleness seemingly (but most surprisingly) facilitates the rolling of sheets and the drawing of wire and tubes having very high strength. Also, the copper-rich inclusions seem to retard grain growth, an effect desirable in castings.

Corrosion-Resisting Properties

Since the potential market for these cypritic steels in the main corresponds to that at present occupied by conventional chrome-nickel and straight-chrome steels, it would be advisable to see how they compare visually and in corrosion resistance in selected media.

Mr. Digby is of the opinion that his steel has a more pleasing tint and velvety mirror surface. The author's visual examination, however, failed to detect any particular difference, although it is faintly possible that the tint is slightly more silvery and softer than in today's commercial stainless steels. There is, however, a tendency for the cyprite phase to drag during polishing, with resultant surface pits. This problem will require considerable additional experimentation.

With respect to corrosion resistance, an examination of data in Table I will indicate that several alloys in the cypritic group possess resistance of a similar order to a conventional straight 17 per cent chrome alloy and 18 chrome-2 nickel steels. But the resistance is not quite equal to that of the popular 18 Cr-8 Ni type of stainless, although it is none-the-less of a very high order in respect to corrosion in the atmosphere, tap water,

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FIG. 3—Full cross-section of a hot-rolled chromium-copper stainless steel sheet, after etching with ferric chloride. The elongated stringers of copper-rich constituent give to this steel a fibrous appearance. The seam shown here on the left-hand surface was one of many on the one surface of this particular sample.

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weak sodium chloride and sodium sulphate solutions. In all the other reagents listed in Table I, the cypritic steels are inferior to the conventional 18 and 8 grade, but note that in most acids a very useful degree of corrosion resistance is evidenced.

The laboratory tests in Table I cover only very short time intervals, and the results shown are spotty and inconclusive. Long-term tests in actual commercial applications are far better criteria, and for this reason the following experiences may be cited. A thin sheet of cypritic steel has been exposed on the roof of a Sheffield, England, steel company for the past six months, the report from the company stating that it "is in perfectly good condition, and no rust has accumulated on the surface . . . a fine rust-resisting material . . . it should be possible to produce it at a price which will allow of a ready sale."

A large Pelton wheel bucket, cast by a well-known English foundry passed all the tests predicated by an equally well-known engineering firm, even though this bucket was cast before the technique of controlling crystal size had been completely mastered. With respect to the bucket, the former firm has written "how extremely pleased we are with the splendid results obtained," and the latter firm has said "we have run one bucket as much as 480 hr. and another 336 hr. without any sign of corrosion taking place."

The record of the cypritic steel in brewery equipment has likewise been commendable. One of England's largest equipment makers has written regarding tests made in several of the larger British breweries: "We tried so many steels, and even where a steel tested right the hardness or working and the cost of fabrication did not make it an attractive proposition . . . surprised with the results (for cypritic steel), and desire to make tests over a longer period." A large brewer states, ". . . tested over a longer period by semi-immersion in beer for one month at laboratory temperature. As before, a faint high water mark was apparent which easily rubs off. Tested for iron and found 0.04 grains per gallon. Acidity developed in the beer during the test was 0.75 per cent as acetic. The iron after one month was no higher than that found after two weeks, and from chemical point of view this metal has excellent properties for resisting any action of beer in contact with it."

The same brewery equipment makers have later reported, ". . . made seven cuts with one hacksaw blade through a bar (cypritic steel) which measured 1½ x 1 in., and the steel cut just as easily as mild steel . . . machined the balance up into hexagon headed valves for fitting combination plugs for fineing beer . . . machining was a great success, and it will bring down production costs considerably . . . we wish to obtain a quantity of bar steel for the purpose of machining plugs for dispensers of carbonated fruit drinks . . . trying for years to find a steel that can be ma-

TABLE I

Corrosion Tests for Digby Chromium-Copper Cypritic Stainless Steels and Conventional Types of Stainless Steels

(Figures indicate total loss of weight in terms of gm. per sq. cm. of surface area)
(Most common grades shown in boldface type)

	ANALYSIS OF STEEL, PER CENT								CORRODING MEDIA									
References	Cr	Cu	Ni	C	Si	S	P	Mn	Sea Water	Sea Spray	5 Per Cent NH_4Cl	B.P. Acetic Acid, Boiling	50 Per Cent Citric Acid, Boiling	1.42 Per Cent HNC_3, Boiling (du Pont Test)	Running Tap Water at 10 Deg. C.	0.1 Per Cent Sodium Chloride	0.1 Per Cent Sodium Sulphate	10 Per Cent Ammonium Sulphate
*	**17.24**	**8.0**	.....	**0.09**	**0.27**	**0.019**	**0.013**	**0.36**	**0.00015**	**0.0003**	**0.0009**	**0.0827**	**0.0004**	**0.1568**	nil	**0.00004**	nil	**0.0001**
*	17.56	10.18	.....	0.09	0.25	0.019	0.016	0.40	0.0002	0.0004	0.0009	0.0006	0.0006	0.5108	nil	0.0001	ni	0.0002
*	17.55	15.16	.....	0.08	0.23	0.019	0.014	0.35	0.0002	0.0004	0.0027	0.0006	0.0008	0.4852	nil	0.0001	0.00005	0.0009
*	14.42	7.96	.....	0.08	0.23	0.019	0.014	0.35	0.00045	0.0002	0.0032	0.0565	0.0008	0.3131	nil	0.00007	0.00004	0.0003
*	**15.04**	**9.52**	.....	**0.05**	**0.42**	**0.018**	**0.015**	**0.28**	**0.0005**	**0.0002**	**0.0012**	**0.0006**	**0.0005**	**0.6207**	nil	**0.00005**	**0.00007**	**0.0002**
*	17.17	.....	.....	0.08	0.25	.....	.....	0.37	0.00005	0.0001	0.00015	0.3144	0.0001	0.0092	nil	0.0002	nil	nil
*†	18	.....	2	.....	.....	.....	.....	.....	nil	0.0001	0.00015	0.0001	0.0001	0.0186	nil	0.0001	nil	nil
*†	**18**	.....	**8**	.....	.....	.....	.....	.....	**nil**	**0.0001**	**nil**	**nil**	**nil**	**0.0038**	**nil**	**nil**	**nil**	**nil**

	ANALYSIS OF STEEL, PER CENT								CORRODING MEDIA			
References	Cr	Cu	Ni	C	Si	S	P	Mn	Nitric Acid, 40 Per Cent, HNO_3, Boiling	Acetic Acid, 10 Per Cent, Plus 5 Per Cent Salt, Boiling	Acetic Acid, 10 Per Cent, Boiling	Lactic Acid, 2 Per Cent, Boiling
**†††	**18.7**	**8.35**	**0.35**	**0.09**	**0.22**	.....	.....	.....	**0.0079**	**0.0058**	**0.00003**	**0.00079**
**	17.1	.....	0.45	0.08	.....	.....	.....	.....	0.0012	0.1123	?	0.00013
**	**17.5**	.....	**0.24**	**0.05**	.....	.....	.....	.....	**0.0042**	**0.0883**	?	?
**	15.3	0.82	0.11	0.05	0.79	.....	.....	.....	0.0032	0.0015	0.00041	0.00032
**	16.2	1.18	0.27	0.06	0.94	.....	.....	.....	0.0031	.....	-	-
**	18.3	.....	8.15	0.06	.....	.....	.....	.....	0.0011	0.0057	0.00409	?
**	**18.0**	.....	**8.30**	**0.06**	.....	.....	.....	.....	**0.0002**	**0.0062**	**0.00296**	**0.00562**

* Tests made in 1935 by a major English steel company. Period of test equaled seven days at a mean temperature of 18 deg. C., unless otherwise stated.

† A complete analysis not given. Probably commercial grades.

** Tests made by a steel firm in Sweden. All test pieces ground on edges with emery paper. Size of test pieces about 60 x 30 x 1.6 mm. Period of test equaled 48 hr.

†† Cold-rolled Digby steel, annealed at 750 deg. C. for 10 min. with air cooling. This particular sample contains 0.35 molybdenum.

chined easily and yet be beneficial and satisfactory to the brewer."

This cross-section of independent opinion is commendable. Next of interest is to see how the steels line up physically.

Physical Characteristics

The mechanical properties of the cypritic steels, as set forth in Table II, are quite surprising. The figures shown are averages from several different laboratories and are consequently somewhat erratic. But, in general, it is evident that the physical characteristics may be compared with those of a steel of the ferritic type containing 17 per cent chromium, manufactured and treated in the same manner. Note in Table II that the most remarkable feature of the mechanical tests is the high impact figure. A feature of all the cypritic steels is an extremely fine grain size, this being particularly marked in steels of lower copper content, i. e., 8 per cent.

An important English steel producer has written to say that copper-chrome steels have been cast in proportions varying between 8 and 15 per cent copper and 15 to 18 per cent chromium. All these analyses have been forged. The "mechanical properties are remarkable for corrosion-resisting types of steel, i. e., ultimate strength from 85,000 to 134,000 lb. per sq. in., yield point ratio of 70 per cent and upwards, per cent elongation in 2 in. ranging from 21 to 30 per cent, and Izod impact figures from 49 to 115 ft.-lb." That the steel is tough is demonstrated by the fracture shown in Fig. 4.

Also, of particular interest are the characteristics of the cypritic steels when drawn into wire. A large Scottish steel rope producer has reduced a quantity of 0.50 in. diameter rod (18 Cr and 8 Cu) to 0.100 in. diameter, and some to 0.050 in. diameter. The material drew very satisfactorily. In mechanical tests, it was discovered that the torsion figures showed a drop as the cold working increased, followed by a sudden rise at approximately 75 per cent reduction. A similar condition exists for conventional 18 and 8 stainless steel.

Investigations by Haigh in a laboratory of a British government department indicate astonishingly great strength under corrosion-fatigue conditions. In fact the experimenter did not think that any metal had yet given such high figures, although galvanizing, so long as it continues effective, has prevented corrosion-fatigue with fatigue limits up to 50,000 lb. per sq. in. in carbon steel wire. Although at the time of writing Haigh had not yet determined the strength of the cypritic wires supplied him, he has good reason to expect that the steel will stand more than the 60,000 lb. per sq. in., which was apparently the approximate limit for 11,000,000 cycles in the 1⅛-in. bar of 116,500 lb. per sq. in. tensile

FIG. 5—Chromium-copper and chromium-nickel hot-rolled sheets were welded together, using a chromium-nickel welding rod in both cases. Polished sections through these two welds are shown here at 20 diameters, the Cr-Cu steel above and the conventional Cr-Ni below. Note the small grains developed in the Cr-Cu steel near the weld and the larger grains developed in the Cr-Ni near the weld. The former was etched with ferric chloride and the latter with aqua regia in glycerine.

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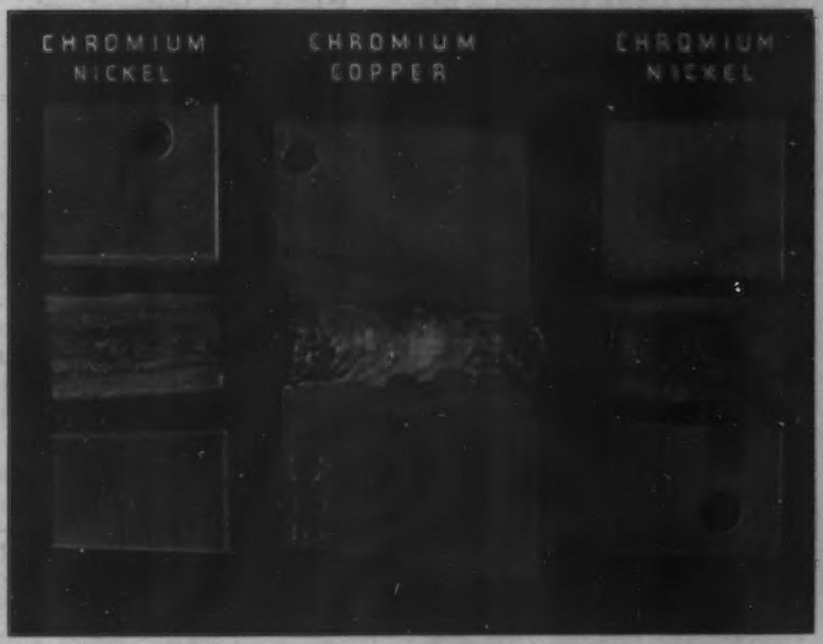

FIG. 6—Intergranular corrosion tests for chromium-nickel (18 and 8 with no columbium or titanium) and chromium-copper stainless steels. Welded samples immersed 12 hr. in a solution of 15 per cent nitric and 4 per cent hydrofluoric acids at a temperature of 160 deg. F. Note the over-all attacked zone on the 18-8 steel and the comparative slight influence on the chromium-copper alloy. The structure of the affected areas may be seen at the top of this page.

strength. Note that the 60,000 lb. per sq. in. corresponds to over 51 per cent of the ultimate strength of the metal. This is a quite normal value for the ratio. It is not to be expected that the same ratio would be maintained in wire, because the surface cannot be as ideal as that of the smoothly finished Wohler test pieces; but even if the ratio falls, it may be expected to give fatigue limits higher than are usually obtainable in carbon steel wire, even in air.

From the nature of the cypritic steels, it would seem that the metal would weld poorly, but such is not the case in experiments conducted by a prominent American laboratory. The welding trials have shown copper to be very effective in retarding grain growth at elevated temperatures. Its effect in this respect seems to be similar to that of nitrogen, particularly with alloys of higher chromium content. The supposition is that the freedom from excessive grain growth adjacent to the welds in the chromium-copper steels is probably due to the "mechanical obstructions" to growth by undissolved copper particles.[11]

Fig. 5 shows the grains developed in welding hot-rolled cypritic steel as compared with conventional chromium-nickel steel. Intergranular corrosion may be said to be essentially absent in the chromium-copper alloy, and a comparison in this respect is shown in Fig. 6. In the chromium-nickel specimens (evidently not treated with columbium or titanium) there is a zone adjacent to and on both sides of the welds which is attacked, but outside those zones is a region severely corroded by the acid. Note the sand-like edge of the specimen completely cut through in Fig. 6. The chromium-copper alloy showed no such zones of weld decay, although there was a somewhat general attack near the weld, which is apparently not intergranular in character.

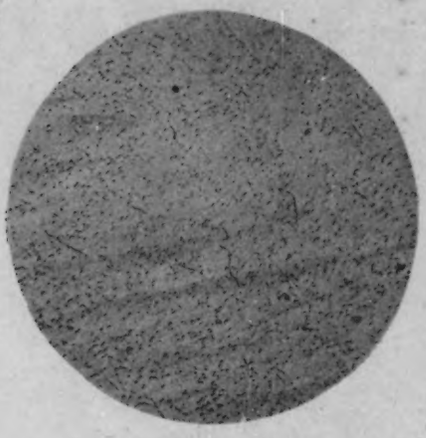

FIG. 7—Microstructure of cypritic stainless steel. (Left) As forged—Brinell value of 255; (Middle) as annealed—Brinell value of 179; (Right) as quenched—Brinell value of 363. All photos at 350 diameters.

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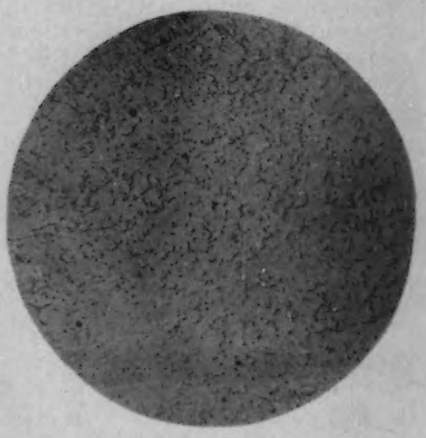
Tests have indicated that a little loss of plasticity seems to be introduced adjacent to the chromium-copper welds, as only two repeated bends through 180 deg. around a ⅛-in. radius were obtained, against 3½ bends for the base metal. This difference would probably be greater if the base metal were in the annealed condition.

A large independent English producer has experimented with the cypritic steels quite extensively, and has written to describe his experiences as follows:

"We have carried out commercial scale melts in our arc furnace, and have encountered no difficulties other than those usually present in making chromium steel. Not only castings but easily forgeable material has been produced of an analysis of 18 Cr, 6 Cu and 0.12 C. Photomicrographs of forged cypritic steel are shown in Fig. 7, and the structure prior to forging may be seen in Fig. 8.

"We have manufactured products commercially as follows: road studs, cast and forged; Pelton wheel buckets; beater arms for food preparation machinery; and bread knives.

"The copper-chrome steel castings and forgings have shown properties over the period during which they have been examined as follows: corrosion—very little different from chromium-nickel subjected to corresponding conditions; physical properties—harder than nickel-chromium, as cast, but the same as forged; tensile strength—castings annealed 90,000 lb. per sq. in. tensile with 25 per cent elongation, against annealing and quenching of conventional nickel-chrome



to obtain approximately the same properties; ductility—low; heat resistance — fair; machineability—better than nickel-chromium alloy.

"Undoubtedly the steels (lower chrome cypritic) do possess certain features of very great interest. The big advantage of the copper-chrome type over the 18 Cr-8 Ni group is that it is possible to harden the former by heat treat-

[11] Intergranular corrosion adjacent to welds in ordinary 18-8 stainless is usually explained by the fact that carbon in solution at ordinary temperatures is rejected in the form of chromium-rich carbides in the grain boundaries at intermediate temperatures. The metal in the immediate vicinity of the carbides is impoverished of its normal chromium content, and hence resistance to corrosion is markedly reduced at points of carbide precipitation which are at the grain boundaries. Heat treatment of the chromium-nickel 18-8 steel is effective in removing the intergranular corrosion sensitivity, but no such treatment can remove the excessive grain growth adjacent to the welds; as all heat treating effects are only to increase the grain size and never to reduce it where there is no allotropic transformation present.

ment, and we have obtained Brinell figures as high as 300. Quite a number of rollings in special heats have been made.

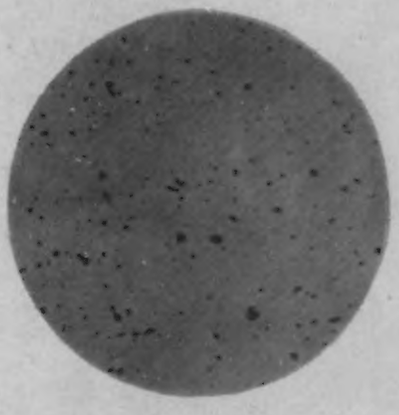
"The question of cost is of course of great importance, and the saving on the addition of nickel, on a large tonnage, are factors to be considered. However, at present the tonnage of copper-chrome steel produced has not enabled us to demonstrate the full effect of this saving."

This question of possible cost advantage should certainly be considered in greater detail, what with the constant consumer pressure in this country to secure better quotations on their stainless steel requirements.

Possible Cost Reduction

The claim that cypritic stainless steels will have a cost advantage over conventional stainless alloys is, of course, merely a prophecy on the part of the inventor, and cannot be backed up by actual production figures.

In a pound of conventional stainless alloy, containing 18 per cent chromium and 8 per cent nickel, the actual nickel cost at 35c. per lb. is, of course, 2.80c. In the cypritic alloy, the chromium content stays approximately the same, but the nickel is replaced by, say, 8 per cent copper. The copper cost thus becomes 1.12c., for copper selling at 14c. per lb. The difference, 1.68c., is not a startling saving in an alloy which might sell for 30c. a lb. in the finished state (because of heavy scrap losses in rolling). But, nonetheless, even this small saving would be desirable.



To compete with conventional straight-chrome alloys, it is evident that the cypritic steels start off with an initial disadvantage; for they contain copper where there was no copper before, and thereby 1.12c. per lb. is added to the cost. But totally apart from these initial variances in cost, Mr. Digby claims that the cypritic alloy will save additional money because ingots and finished products may be rough machined more cheaply, and the steel is extremely flexible in meeting a greatly varied set of physical demands, merely through the manipulation of a simple form of heat treatment.

This question of having a few varieties of steel to meet the major demands of stainless consumers, merely by varying a heat treatment, is certainly attractive; for there is no denying that the trade is currently confused by the flood of patented and special mixtures sold under the general title of stainless steels. With each shift in composition to meet a particular demand the steel maker may come forth with a new name, the result being so many varieties that the mere enumeration of the names of the permutations covers 12 closely printed pages in "The Book of Stainless Steels." Perhaps cypritic steels will merely add one more name to this list, or perhaps they may actually match the inventor's optimism and really introduce some badly needed simplification in the current confusing commercial picture.

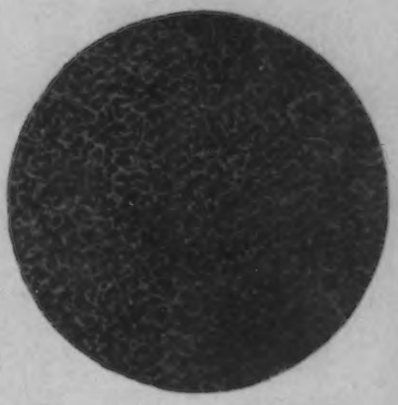


FIG. 8—Microstructure of chromium-copper stainless steel before forging. (Left) As cast, polished but not etched; Brinell value of 444. (Above) As cast, polished and etched with ferric chloride. The dark portion in this view is the iron constituent, the light network is the cyprite constituent. Both photographs are at 100 diameters.

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Conclusion

In all the foregoing paragraphs the author has emphasized that the novelty of these cypritic stainless steels does not rest upon some relatively small addition to or alteration in existing steels, but upon the fact that they constitute an entirely new group of stainless steels with qualities in certain respects apparently commensurate with existing types. The data presented in all cases have been checked to the best of the author's ability—practically all of it has originated in well-known laboratories abroad whose reputations are unimpeachable, but whose names for the time being are deliberately withheld. Admittedly, much work must yet be performed on the alloys, but in their present stage of development they certainly show as much promise as or even more promise than the great mass of other alloys, now commercially prominent, during their early history.

The advisability of having as much copper-rich phase present as is found in the cypritic steels naturally might be questioned. Perhaps certain properties would be changed markedly by lowering the copper content several per cent; machining properties might be made less desirable, but it is possible that forgeability might be improved so that better surfaces could be obtained—this latter characteristic being particularly desirable. It also might be said that corrosion resistance is probably imparted for the most part by the copper in solution rather than that in the second phase (cyprite). But on the contrary, it is also possible that since the rolling is carried out at a low temperature, the numerous copper-rich stringers actually improve the forgeability. Undoubtedly there is an optimum copper content or copper range above which no real benefit is derived from additional copper, and it might be a promising field of research to determine whether this optimum copper content is around 10 per cent, as in the cypritic steels, or is a lower figure.

METAL TREATING FURNACES AND REFRACTORIES

ABOMINABLE heat treating once lost France the world. The Gauls, in 200 B.C., would have picked off the more effete Romans with ease had not the wily Consuls noted that the northerners' swords were so bent and edges so turned after one downward cut that the blades were of necessity placed on the ground and straightened with the foot. So, in the deciding battle, the Consuls reversed usual procedure and first sent in lancers to take the blows and bend the swords, then Roman swordsmen quickly crowded in to efficiently finish off the helpless invaders.

But heat treating alone no longer decides the ebb and flow of nations; it can, however, have a potent influence on the sport of nations, as, for instance, yacht racing. America's Ranger overwhelmed England's Endeavour II last july, because of superior handling and design; the latter hinged on cleverly heat treated rigging, and the technique involved and results obtained are most interestingly and informatively described in Mr. Knerr's article, which follows.

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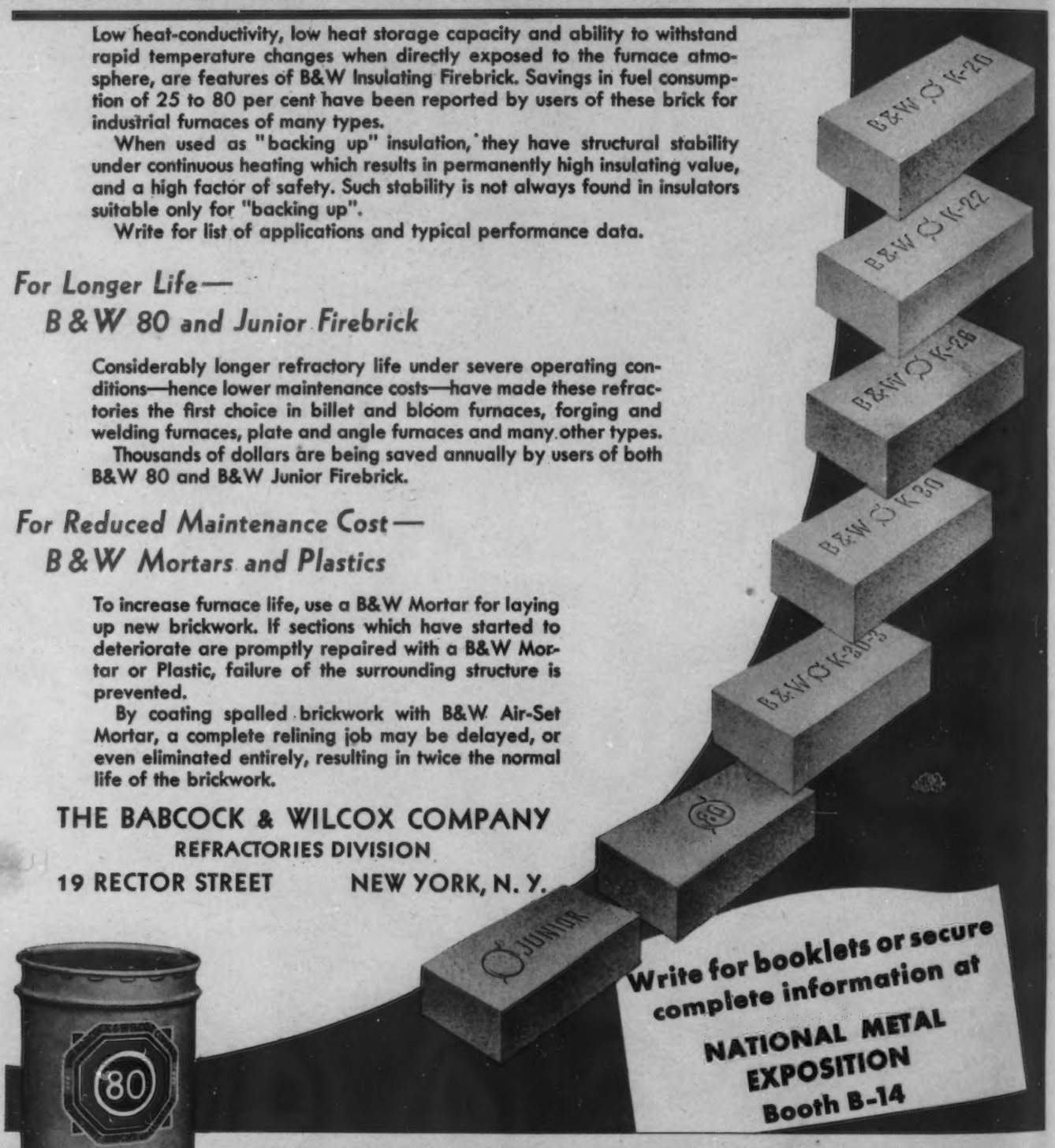

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THE HEAT TREATING of a

WINNER

By HORACE C. KNERR*

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THE sport of major yacht racing has become steel conscious, as designers search for greater lightness, strength and dependability, and strive for efficient streamlining.

America's 1934 cup defender, Rainbow, introduced unique solid steel stay rods to brace the mast in place of conventional cables. The result was a saving in weight, wind resistance was reduced, and, most important, an undesirable characteristic of steel cable—stretch—was avoided.

To develop necessary strength-weight efficiency, Rainbow's stay rods were made of alloy-steel (chromium-nickel, SAE No. 3240), heat treated to a specified minimum tensile strength of 180,000 lb. per sq. in. The set of rods was made in duplicate, as shown in Fig. 1. The heat treatment of these slender rods, some of which were more than 18 ft. long, presented a difficult and unusual problem, as they had to be kept quite straight, free from scale or decarburization, and very uniform. Treatment was carried out in a vertical furnace by the Metlab Co., and the technique was reviewed in THE IRON AGE, Sept. 27, 1934.

These rods performed so satisfactorily in service that Starling Burgess, designer, decided to use them again in Commodore Vanderbilt's new defender, Ranger, whose outstanding performance in winning this year's cup race is now a matter of history.

The rods are arranged on each side of the mast to form a truss, steel tubes being used for the compression members, as shown in Fig. 2. The mast is of duralumin.

To guard against such possibilities as fatigue cracks, flaws or other mechanical defects, the original Rainbow rods were returned to Metlab for inspection and reconditioning. They were tested over their entire length, including the threaded ends, by the Magnaflux process, using both the dry and the

*Consulting Metallurgical Engineer, and President of Metallurgical Laboratories, Inc. (Metlab Co.), Philadelphia.

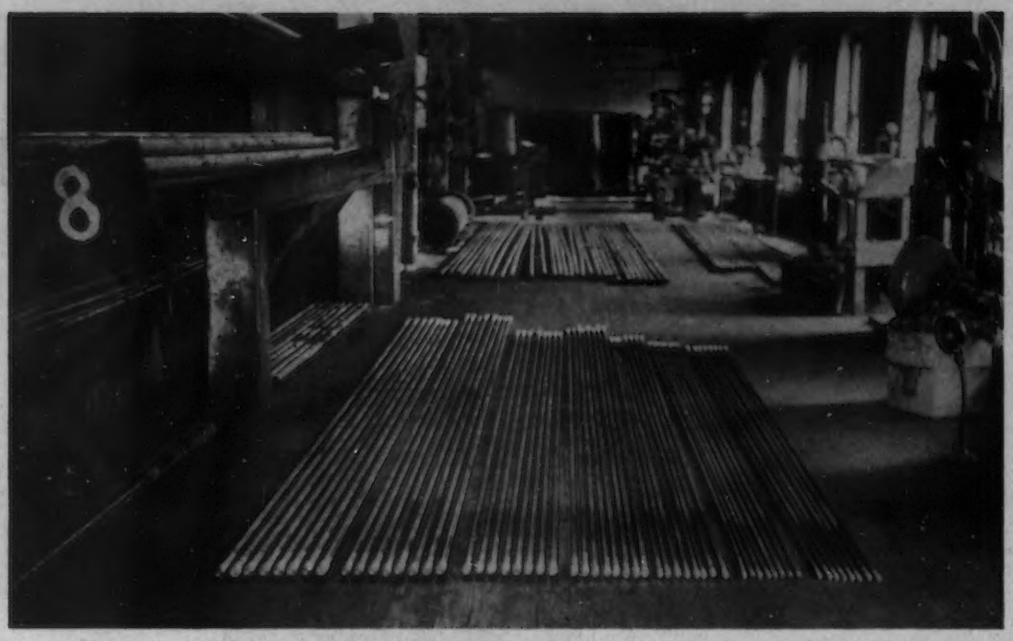

FIG. 1—The 1934 cup defender's (Rainbow) stay rods, made of SAE No. 3240 steel, heat treated to a minimum tensile strength of 180,000 lb. per sq. in.

wet procedure. This test, as is well known, consists in magnetizing the steel article and then bringing in contact with it a very fine magnetic powder which adheres to points where flaws exist, thereby revealing them. The powder may be dusted on dry or used as an emulsion in oil (see Fig. 3).

All the parts, including the rods and their terminal fittings and turnbuckles, were found to be in perfect shape, excepting one very small defect. This defect apparently was due to a slight inclusion in the steel; it was, however, located at a point which rendered it comparatively harmless.

A quantity of new fittings were made for Ranger, for attaching the stay rods to the mast, for deck connections and the like, and a few of these fittings are shown in Fig. 4. These fittings were made by the Bath Iron Works, of SAE No. 4130X and No. 4140 steel, and forwarded to Metlab for heat treatment to a minimum tensile strength of 150,000 lb. per sq. in. Some short rods, shown with the fittings

TABLE III

Typical Proof Tests on Ranger Stay Rods

Rod No.	Piece No.	Diameter, In.	Area, Sq. In.	Brinell Hardness	Test Specimen, Ultimate Load per Sq. In.	Stress at Proof, Lb. per Sq. In.	Ranger Proof Load (1937), Lb. per Sq. In.	Rainbow Proof Load (1934), Lb. per Sq. In.	Proof of Load Increase, Per Cent	Thread Size	Weight of Rods, Lb.
V-1	15	...	....	460	209,800	.....	.....	.....	..	.....	...
V-1	16	1.17	1.073	444	203,000	116,000	127,000	95,666	34	1½"-12	318
V-1	17	...	....	444	218,000	.....	.....	.....	..	.....	...
V-1	18	...	....	444	205,300	.....	.....	.....	..	.....	...
D-1	11	...	....	...	.....	.....	.....	.....	..	.....	...
D-1	12	0.98	0.752	460	208,800	118,000	90,000	67,918	33	1¼"-12	241
D-1	13	...	....	...	.....	.....	.....	.....	..	.....	...
D-1	51	...	....	430	214,400	.....	.....	.....	..	.....	...
V-2	6	...	....	418	200,200	.....	.....	.....	..	.....	...
V-2	19	0.86	0.582	444	214,500	114,500	67,000	51,122	32	1"-14	141
V-2	25	...	....	430	201,400	.....	.....	.....	..	.....	...
V-2	26	...	....	418	200,500	.....	.....	.....	..	.....	...
D-2	8	...	....	...	.....	.....	.....	.....	..	.....	...
D-2	10	0.82	0.53	418	209,200	110,500	60,000	46,228	30	1"-14	135
D-2	23	...	....	...	.....	.....	.....	.....	..	.....	...
D-2	24	...	....	418	204,000	.....	.....	.....	..	.....	...
D-3	27	...	....	...	.....	.....	.....	.....	..	.....	...
D-3	28	0.66	0.343	430	200,800	112,000	40,000	30,975	30	¾"16	85
D-3	29	...	....	...	.....	.....	.....	.....	..	.....	...
D-3	30	...	....	444	202,000	.....	.....	.....	..	.....	...
V-3	31	...	....	...	.....	.....	.....	.....	..	.....	...
V-3	32	0.58	0.265	444	200,800	103,000	28,000	22,981	27	¾"-16	61
V-3	33	...	....	...	.....	.....	.....	.....	..	.....	...
V-3	34	...	....	460	202,000	.....	.....	.....	..	.....	...
4	40	0.58	0.265	410	190,500	113,000	30,000	22,981	30	¾"-16	54
4	41	...	....	...	.....	.....	.....	.....	..	.....	...
4	42	...	....	...	.....	.....	.....	.....	..	.....	...
4	43	...	....	...	.....	.....	.....	.....	..	.....	...

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TABLE I

Test Results for the Short Rods and Special Fittings Shown in Fig. 4

	Yield Point, Lb. per Sq. In.	Ultimate Stress, Lb. per Sq. In.	Elongation, Per Cent
Short rods (SAE No. 3240).....	205,000	211,000	9
Boat fittings (No. 4130X).....	159,000	169,000	15.5
Boat fittings (No. 4140).....	149,000	158,500	13.5

TABLE II

Typical Results From Tensile Specimens Heat Treated With Ranger Stay Rods*

Specimen Mark	Yield Point†, Lb. per Sq. In.	Ultimate Stress, Lb. per Sq. In.	Elongation, Per Cent in 2 In.	Reduction in Area	Steel
D-1-51	205,200	214,400	12.5	46.3	6145
D-2-10	196,100	209,200	13.0	48.1	6145
V-2-6	193,800	200,200	12.5	48.4	6145
V-2-25	193,700	201,400	13.0	45.2	3340
V-2-26	192,000	200,500	12.5	43.9	3340

*Tests by Tinius Olsen Co. †By dividers.

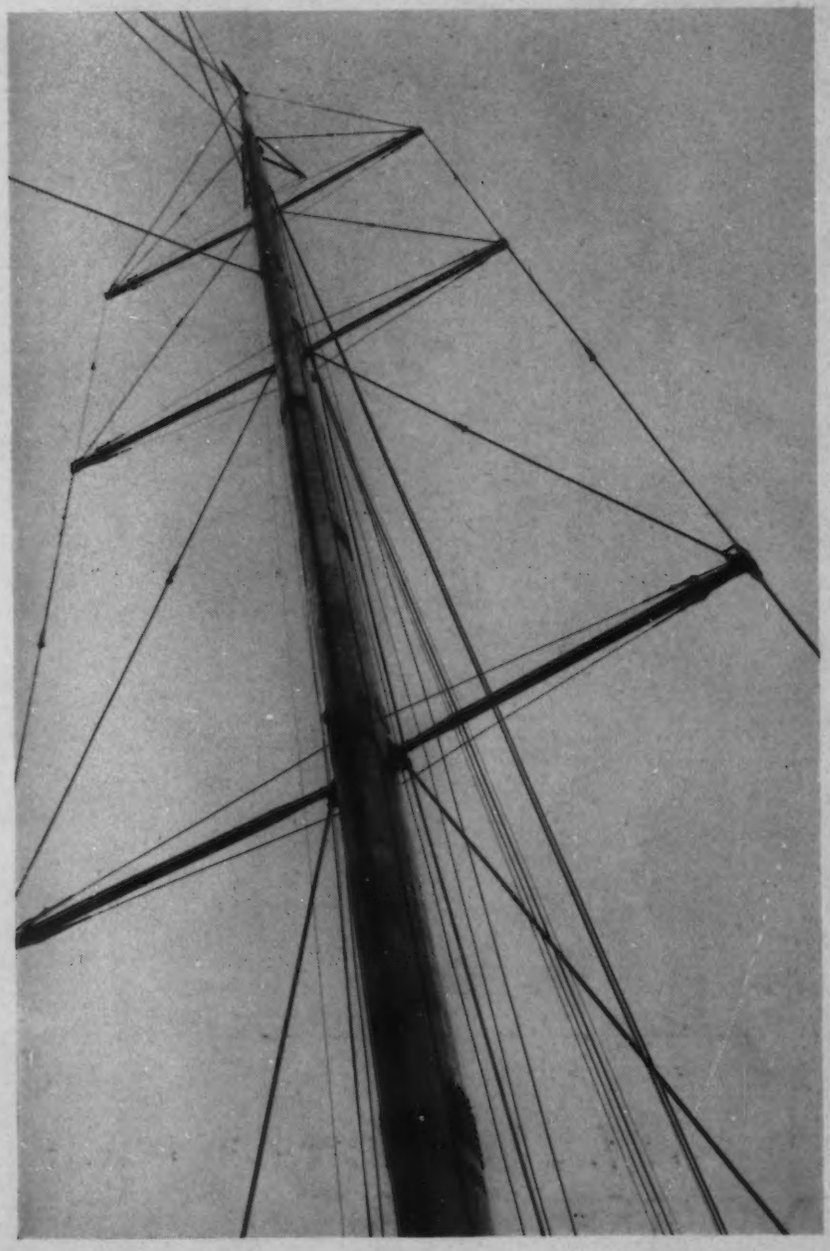

FIG. 2—Steel rods are arranged on each side of a duralumin mast to form a truss. Compression members are tubular. Picture by Edwin Levick.

in Fig. 4, were made of No. 3240 steel, with a specified minimum tensile strength of 200,000 lb. per sq. in. These rods were heat treated in the Metlab vertical furnace, and test data for the fittings and rods appear in Table I. As a final operation, all the heat treated parts were cadmium plated.

Fitted with her new steel rigging, Ranger began test runs early in May. Then, on May 15, a serious and unfortunate accident occurred. Caught in a storm at sea during the night, one of the turnbuckles in the upper section of rigging backed off. (Observers say that no part broke at this stage). The result was slack in the whole system of truss bracing, on both sides of the mast, and the mast was therefore unsupported and free to swing. Loosening of the system caused additional turnbuckles to become undone and other joints to separate. Owing to the heavy weather, the darkness and the fact that all extraneous parts had been eliminated from the rigging for lightness and cleanness of design, repairs could not be made at sea. As the vessel proceeded to port in tow of her power tender, the mast sway was so pronounced that it finally broke off about 30 ft. from the deck, going overboard with the rigging.

It is interesting to note that the designer was so pleased with the strength shown by the duralumin mast, under the terrific abnormal stress to which it was exposed, that he specified a considerably lighter replacement mast. Furthermore, to positively prevent loosening of turnbuckles in service in the future, a new form of locknut was devised.

Undaunted by the calamity, Commodore Vanderbilt gave instructions to replace the lost mast and rigging immediately. The time for crew practice and trials was at that date exceedingly short, and every day lost might have a significant influence on the final outcome of the race.

The morning following the ac-

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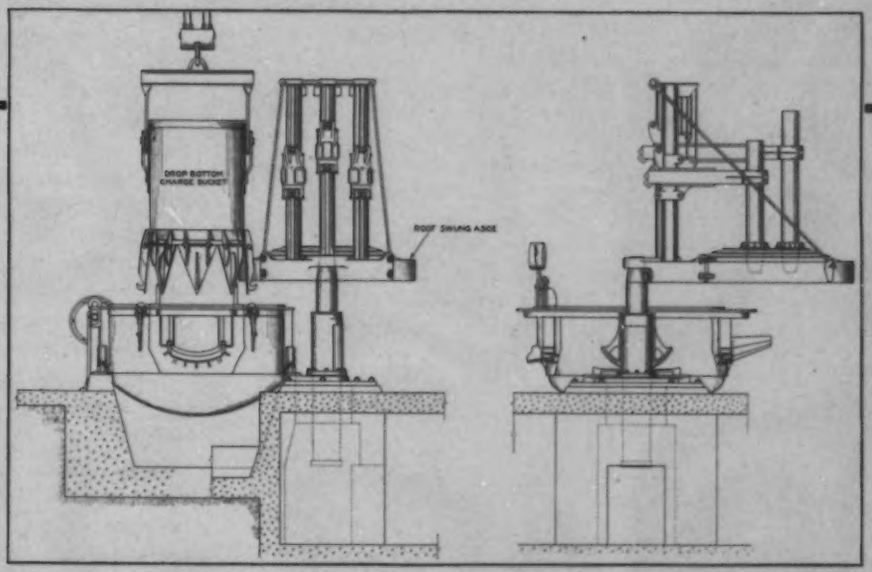

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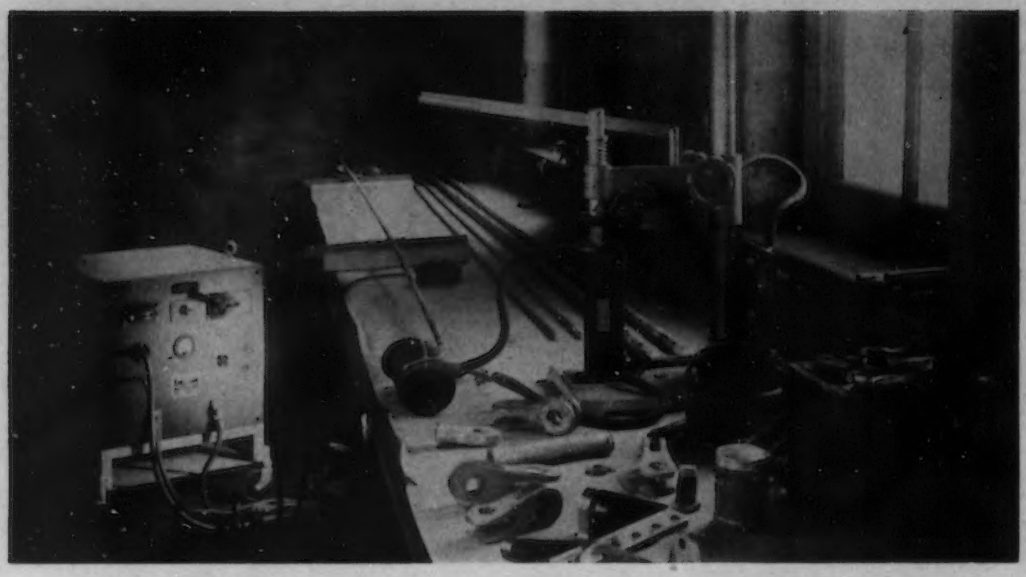

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FIG. 3—The original Rainbow rods were tested by the Magnaflux method, as shown here, before being re-assembled in the Ranger rigging.

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cident, a long distance call was received from Bath Iron Works in Maine, ordering a complete new set of steel rigging for immediate delivery. A similar order had been placed with the Aluminum Co. of America for the new mast. It was necessary that these two orders be completed simultaneously and assembled on the boat at her dock at Newport. Meanwhile, a temporary mast and cable rigging were installed in order that daily practice could be continued.

Now, it so happened that during the early morning hours of May 3, the day on which delivery had been made on the first lot of fittings and the reconditioned stay rods, a disastrous fire nearly destroyed the Metlab plant, and the finished parts were saved by great good fortune. But the fire thoroughly wrecked the vertical furnace which was used for heat treating the long rods. Therefore, when the new order was received for stay braces, it seemed most uncertain that the work could be completed. Fortunately, the Naval Aircraft Factory at the Philadelphia Navy Yard has a somewhat similar though smaller vertical furnace. The critical situation was explained to Naval officials, who very generously permitted the use of their furnace to meet the emergency.

But first it was necessary to obtain steel for new rods. The original steel analyses could not be replaced within six weeks, which of course was out of the question. Other suitable steels, therefore, had to be found in Philadelphia warehouses. To complete a set of braces, two types of steel were employed, namely No. 6145 (chromium-vanadium) and No. 3340 (chromium-nickel). SAE No. 4140 steel was also considered, but it was not available in the sizes required.

The large threaded ends of the stay rods had originally been made by upsetting, but the dies were no longer available. This difficulty was overcome by using oversize rods and turning down the reduced section in a lathe. A generous fillet was left at the base of the threaded portion. A cross-section of every rod was deep-etched, and all were sound and free from flaws. New replacement fittings were machined from pre-heat-treated bar stock, No. 6140 (chromium-vanadium).

Heat treatment of the rods at the Naval Aircraft Factory was further complicated by the discovery that the working length of the furnace was less than originally anticipated, and therefore too short for some of the rods, even though the longest ones had been cut down and their terminal fittings lengthened. Last-minute alterations had to be made.

The method of heat treatment was similar to that described in the previous article in THE IRON AGE. Several rods were hung on a spider of heat resisting alloy so that each was suspended true and

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FIG. 4—Some new fittings for Ranger, heat treated to a minimum strength of 150,000 lb. per sq. in. The short rods, made of SAE No. 3240 steel, have a strength of 200,000 lb. per sq. in.

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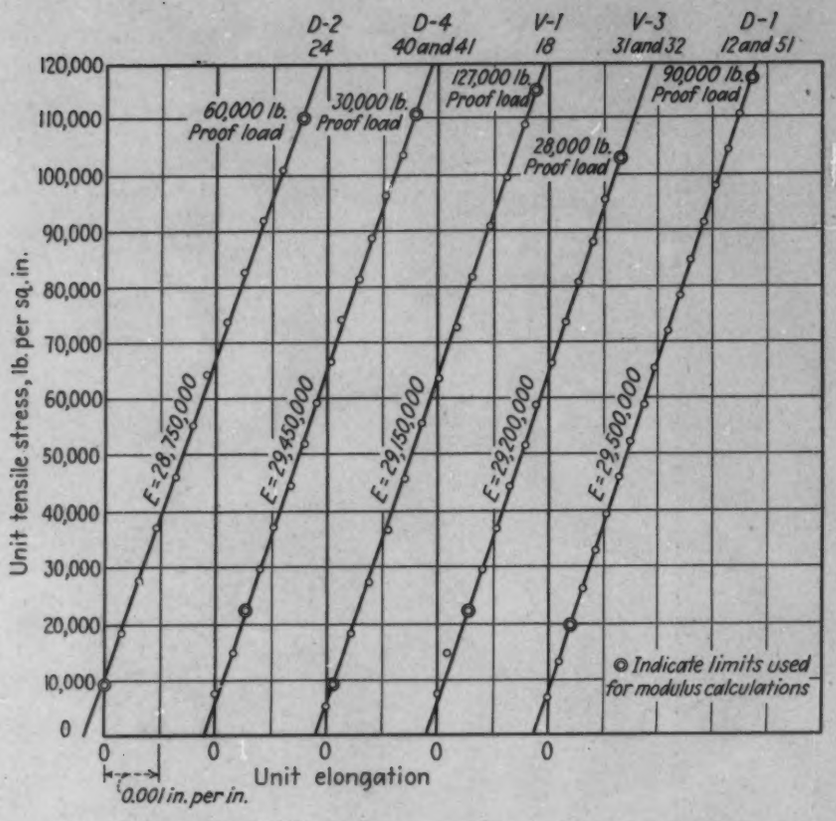

FIG. 5—Modulus tests on stay rods for Ranger rigging. Elongation measurements for modulus made with 8-in. gage length Ewing extensometer. For member D-4, the instrument was on stay rod No. 41; for V-3, on No. 32; and for D-1, on stay rod No. 51. A nickel-chromium steel, SAE No. 3340, used for D-2 No. 24, and the material used for the other tests was chromium-vanadium steel, SAE No. 6145.

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plumb from one threaded end. The spider was then drawn up into the vertical furnace through the door in its base. After a period of preheating, the work was soaked at a suitable temperature, 1575 deg. F. for No. 6145 steel and 1425 deg. F. for No. 3340 steel, and then quenched by lowering directly out of the bottom of the furnace into a deep tank of oil beneath.

The same furnace was used for tempering on the following day. Scaling or decarburization of the threads and the surfaces of the rods had to be rigorously avoided.

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Test specimens made from sections of the same bar stock were hung with each lot of rods at the middle, top and bottom of each heat. The results of the tensile tests appear in Table II.

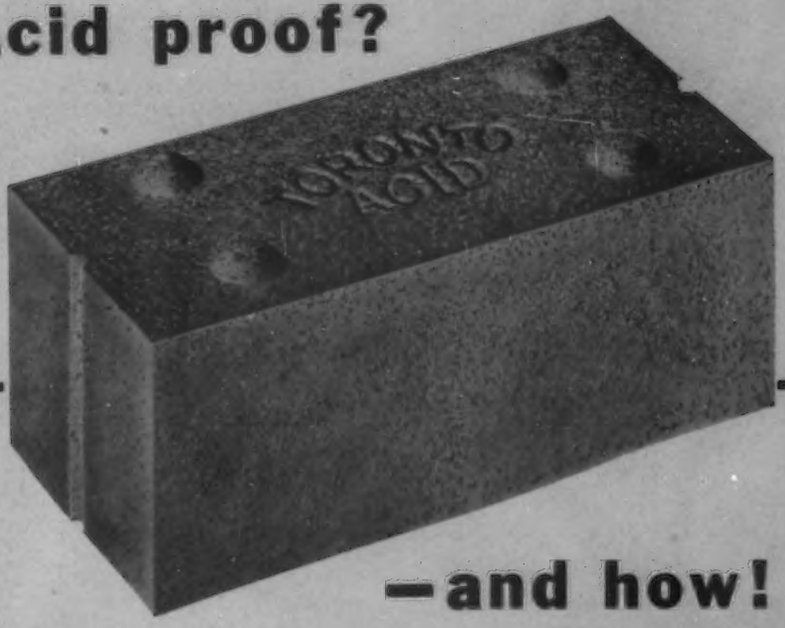
All the finished parts were cadmium plated. Finally, the rods were taken to the plant of John A. Roebling's Sons Co., where a proof test exceeding maximum calculated service stresses was applied to every rod, assembled with its fittings and turnbuckles. The proof load was 30 per cent higher than that which had been applied to the original Rainbow rods, and the experimental figures appear in Table III. Typical stress-strain diagrams made on several of the rods themselves are shown in Fig. 5. The straightness of these stress-strain "curves" is noteworthy, and is distinctive from the curvature sometimes obtained with cold-worked material, or material in which internal stresses or other instability remains at high heat-treated values when such parts have not been thoroughly tempered, or where they have been severely cold-straightened after heat treatment. These rods were so straight after hardening that practically no cold-straightening was necessary.

It is interesting to note that steels of three different types were used for the rods and fittings—chromium-nickel, chromium-vanadium and chromium-molybdenum, each in more than one analysis. Any one of these steels was or could be heat treated within the range of strength values employed, 150,000 to 200,000 lb. per sq. in., and would, according to the writer's experience, perform quite satisfactorily in service. Provided these steels have been well made and are correctly heat treated, no great differences in their properties and behavior are likely to be found. The molybdenum and vanadium steels are considered more readily machineable in the heat-treated state, while the chromium-nickel steels have the advantage of a lower hardening temperature.

The specter of brittleness still frightens some persons when considering such steels having high tensile strength. But this danger is belied by the elongation and reduction of area values shown in the accompanying tables. Any of the steels referred to will stand a severe cold bend at a tensile strength exceeding 200,000 lb. per sq. in. To prove this point, a convincing argument is to bend a well rounded bar by hammering it, until it breaks. Sharp angles, grooves or notches must be avoided because these are primary sources of failure in both low-strength and high-strength steels, and their effect is particularly pronounced in the latter.

The entire rush order for rigging details, which normally would have required three months, was completed in 20 working days, largely due to the intensive efforts of E. Burke Wilford, head of the Pennsylvania Aircraft Syndicate, who engineered the job, aided by Sam Wakeman, of Bath Iron Works, and the close cooperation of several Philadelphia industries, including Horace T. Potts Co., Peter A. Frasse, Wiedemann Machine Co., Peco Manufacturing Co., E. F. Houghton Co., and Philadelphia Rust Proof Co.

Acid proof?



—and how!

TORONTO
ACID BRICK

When you lay up tank walls and floors with Toronto Acid Brick, you know the job is tight as a drum and it's going to stay that way because Toronto Acid Brick are repressed and deaerated, making them extremely dense and impervious to any acid action.

MADE ESPECIALLY FOR ACID TANKS

Eight standard shapes of Toronto Acid Brick are carried in stock for prompt shipment. Special shapes can be supplied to meet your needs. All are designed for use in acid tanks. On the standard blocks, spacing buttons and end grooves insure uniform self-anchoring joints at minimum labor cost.

DESIGNED FOR USE WITH BASOLIT

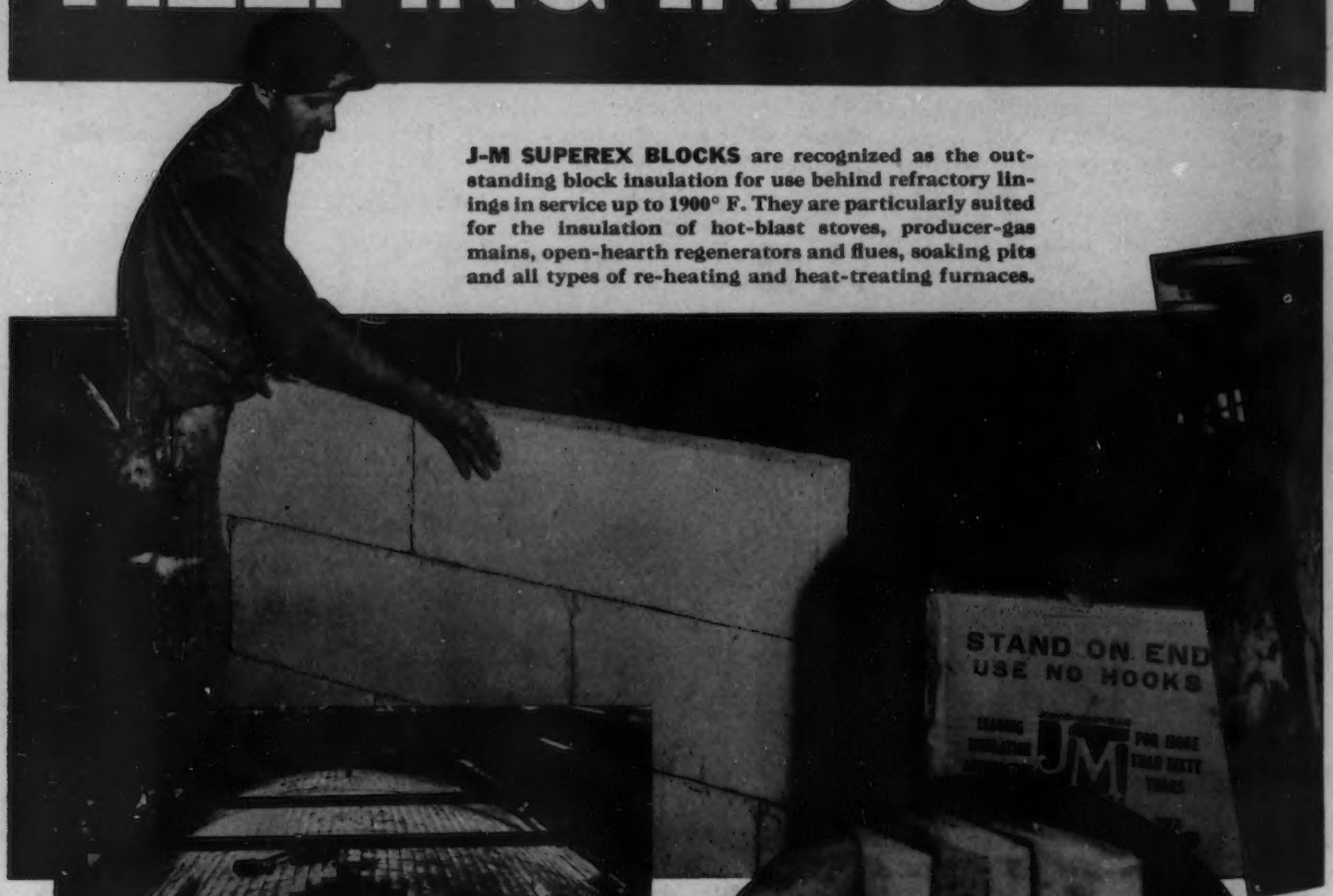
Toronto Acid Brick are designed especially for use in connection with Basolit, the acid-proof cement joint. A list of the users of Toronto Acid Brick is an honor roll of American industry. Write us for further information and samples, which will be sent promptly on request.

THE KEAGLER BRICK CO.

STEUBENVILLE, OHIO

Fire Clay, Acid Resistant Brick, Fire Clay Mill Brick, Pickling Tank Linings, Acid Proof Construction, Paving Brick, Paving Block, Chimney Stack Brick.

HELPING INDUSTRY



J-M SUPEREX BLOCKS are recognized as the outstanding block insulation for use behind refractory linings in service up to 1900° F. They are particularly suited for the insulation of hot-blast stoves, producer-gas mains, open-hearth regenerators and flues, soaking pits and all types of re-heating and heat-treating furnaces.

SIL-O-CEL C-22 BRICK, as a combination insulation and refractory lining in walls and roof of this normalizing furnace, makes possible thinner walls and improved operating efficiency.

JM-20 BRICK is equally effective as a back-up insulation material or as an insulating refractory for operating temperatures up to 2000° F.

SIL-O-CEL NATURAL BRICK is the most efficient insulating brick obtainable for use behind refractory linings where subjected to temperatures up to 1600° F.

HARNESS *Heat*

SIL-O-CEL C-3 CONCRETE for lining furnace doors and bases conducts less than one-third as much heat as firebrick; weighs less than half as much. It is also the ideal material for insulating open-hearth flues and those sections of the regenerator system below ground.

For Every Operating Temperature ... for Every Type of Furnace ... There's a J-M Insulation that Will Give Maximum Efficiency and Economy

BACK of the complete line of Johns-Manville Insulations is an engineering and research organization that has specialized for years in the science of heat control. Experienced in the solving of every steel-mill insulation problem, J-M engineers have developed specialized insulating materials and insulation methods that have helped the iron and steel industry improve performance and lower operating costs on every type of heated equipment.

Five of the most widely used J-M Insulations are shown here. Each is designed to do a specific job, efficiently and economically. And for boilers, steam lines and other insulation requirements, there are additional J-M Insulations that are equally effective in the service for which they were designed.

For complete information on all Johns-Manville Insulating Materials, visit Booth C-43 at Atlantic City. Or write Johns-Manville, 22 East 40th Street, New York, N. Y.

See Our Exhibit at
NATIONAL METAL EXPOSITION
Atlantic City, Booth C-43

JM Johns-Manville
INDUSTRIAL INSULATIONS
An insulating material for every temperature . . . for every service condition

FOR ALL HEAT-TREATING OPERATIONS

There's Nothing Like GAS For

HARDENING — CARBURIZING
ANNEALING — FORGING
TEMPERING — GALVANIZING
NORMALIZING — CORE BAKING
BLUEING — MALLEABLIZING
NITRIDING

And many other industrial processes

BECAUSE better heating methods insure more uniform production; and

BECAUSE new developments in the application of GAS and in GAS equipment make GAS more flexible and satisfactory than any other fuel—

Hundreds of firms in the heat-treating field will turn this year to GAS for automatic perfection in their output.

BECAUSE GAS shortens heating-up time and saves wasteful production delays all along the line; and

BECAUSE a modern GAS installation invariably results in lower operating costs per unit—

Other hundreds of firms this year will rely confidently upon GAS to keep their selling prices effectively competitive.

Prolonged and intensive research on GAS applications has resulted in important improvements which make GAS today even more economical for all heat-treating operations. Ask your gas company for detailed facts about this new, advanced equipment which is swinging firms, both large and small, into profitable step with today's decided trend to GAS.

AMERICAN GAS ASSOCIATION

INDUSTRIAL GAS SECTION: 420 LEXINGTON AVE., NEW YORK

HANDLING HEAT

For Melting Metals . . .

ALUNDUM, CRYSTOLON and Fused Magnesia Cements and Bonded Shapes

For Heat-Treating Metals . . .

CRYSTOLON Hearth Plates

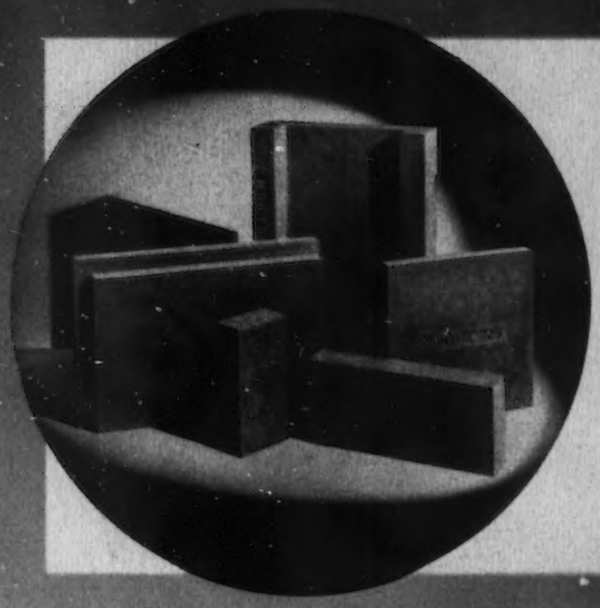
For Enameling Metals . . .

ALUNDUM Muffles

NORTON REFRACTORIES

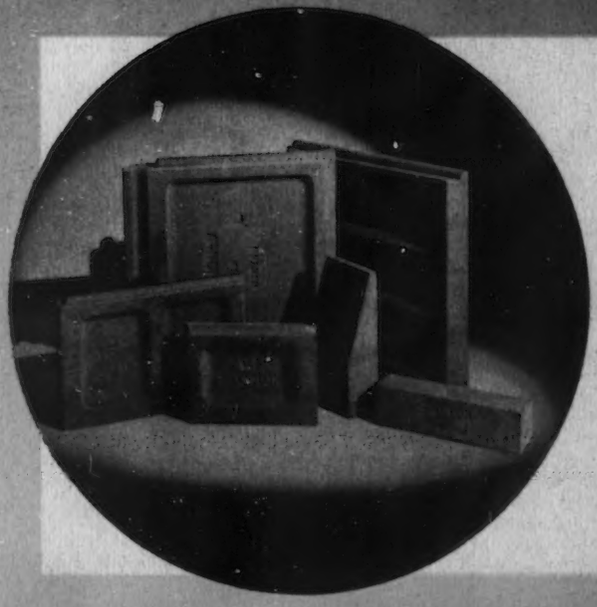
FOR MELTING METALS

In many types of furnaces for melting ferrous and non-ferrous metals, Norton Alundum (fused alumina), Crystolon (silicon carbide) and fused magnesia cements and bonded shapes are widely used — in different mixtures to meet different conditions. Their special features are: resistance to high temperatures, chemical resistance, and low permeabilities to molten metals and oxides.



FOR HEAT TREATING METALS

Crystolon Refractories (silicon carbide) are widely used in heat treating furnaces of many different types. They are popular because of these features: resistance to high temperatures, great strength, high heat transfer, resistance to spalling, resistance to abrasion, long life, low fuel cost.



FOR ENAMELING METALS

For enameling cast iron or steel in Ferro box type or continuous furnaces Alundum Refractories have been standard for many years — standard because of these important characteristics: resistance to high temperatures, great strength, high heat transfer, chemical stability, long life, low fuel cost.

NORTON COMPANY, WORCESTER, MASS.
New York Chicago Detroit Philadelphia Pittsburgh
Hartford Cleveland Hamilton, Ont. London Paris
Wesseling, Germany Corsico, Italy

NORTON REFRACTORIES

. . . and you CONTROL A VITAL FACTOR *in Heat Treating*

No longer need you wait for a report on the furnace atmosphere while work may be spoiling. Direct reading of the Brown ANALY-GRAPH measures furnace atmosphere in simple, workable terms. It gives accurate, unfailing response to variations in the atmosphere and humidity conditions—whether combustion is complete or incomplete.

To measure furnace atmospheres with the Brown ANALY-GRAPH —while work is being treated—is to *know in advance* that the final result *will exactly meet* the desired specifications. It means, further, that you can easily avoid faulty hardening . . . expensive retreatments . . . rejections due to excessive scaling, undesired carburizing or decarburizing.

The Brown ANALY-GRAPH enables you to check the exact amount of oxidation and reduction in the furnace atmosphere—for any metal—at any temperature. Thus, you have a tangible, instantaneous and continuous means of controlling quality and uniformity of result—a VITAL FACTOR in heat treating.

An outstanding advantage is that once the ideal condition is established and recorded, it can be quickly duplicated whenever desired—batch after batch—by any operator.

Other advantages and detailed descriptive data are given in Bulletin No. 92-1. Write THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4483 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada: 117 Peter Street—Amsterdam-C, Holland: Wijdesteeg 4—London, England: 70 St. Thomas' Street, S.E.I.

The ANALY-GRAPH is fool-proof, simple in operation and easily installed on any furnace—electric or fuel fired—wherein furnace atmospheres are controllable.

A constant sampling of the furnace gases directly in contact with the work is conducted by means of an analyzing unit. Briefly, the procedure is as follows:

Furnace gases are drawn through a sampling tube, drier and filter. The gases upon entering the *Gas Analysis Cell* cause the electrically heated cell to get hotter—increasing the electrical resistance. The rise and fall of electrical resistance with changes in furnace atmospheres affects the galvanometer in the recording instrument which produces a continuous record of oxidation or reduction.

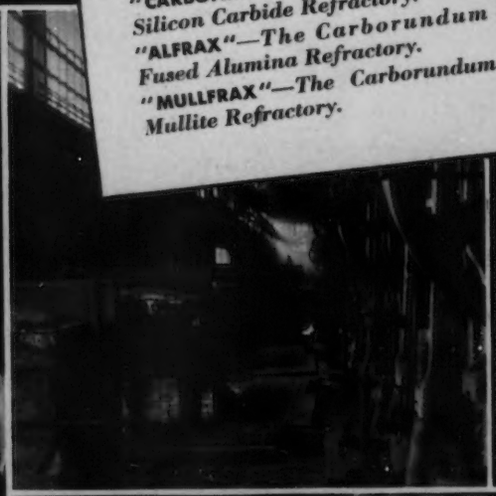
Thus, the furnace man is supplied with a continuous record, on a standard 12-inch chart, of the furnace atmosphere as produced by any degree of combustion.

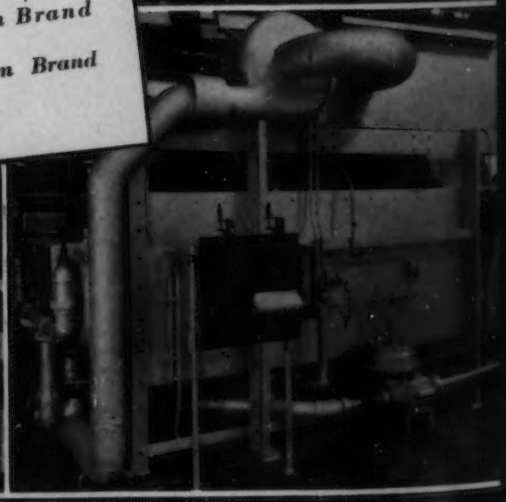
SEE THE ANALY-GRAPH IN OPERATION AT THE NATIONAL METAL EXPOSITION—BOOTH B-75-79.

BROWN FURNACE ATMOSPHERE RECORDER

To Measure and Control is to Economize

...inevitably





HEAT-TREATING APPLICATIONS

Refractories by Carborundum have become the standard Super Refractories of the metal industry because:

1. *They are not affected by high temperatures.*
2. *They have extremely high heat conductivity.*
3. *They withstand sudden temperature changes.*
4. *They withstand abrasive wear.*
5. *They withstand the corrosive and erosive effects of many metals and slag.*

The many applications of Carborundum Brand super refractories in the metal industry are too numerous for complete listing. "Carbofrax", "Alfrax", or "Mullfrax" refractories, however, are used as muffles, hearths, supports or complete linings in stainless steel annealing furnaces—tungsten carbide sintering furnaces—controlled atmosphere furnaces for alloy steels—forging, drawing, tempering, hardening and carburizing furnaces—ferrous and non-ferrous melting furnaces.

In hundreds of installations, these refractories by Carborundum are speeding up production—bettering the quality of the product—reducing costs.

We would be glad to discuss your problems at any time.

"CARBOFRAX"—*The Carborundum Brand Silicon Carbide Refractory.*
"ALFRAX"—*The Carborundum Brand Fused Alumina Refractory.*
"MULLFRAX"—*The Carborundum Brand Mullite Refractory.*

THE ANSWER IS FOUND IN REFRACTORIES *by* CARBORUNDUM

Visit the
CARBORUNDUM EXHIBIT
Space H-24 — H-34
NATIONAL METAL CONGRESS
Atlantic City, Oct. 18 to 22

RECUPERATOR APPLICATIONS

Here's the record of a Carborundum Company Recuperator on a malleable iron air furnace making two heats a day. The recuperator has been in service for more than seven years.

Every day during the time the furnace has been worked, the gases entering the recuperator structure have gone from room temperature to 2400 deg. F. in three hours or less. These extreme temperature changes have left the "Carbofrax" heat transfer elements unharmed in any way and the maintenance charges per ton of metal poured have been negligible.

But the story of what it has done for the user is even more interesting. It has cut his fuel consumption in half as compared with cold air operations and has given certain metallurgical advantages plus closer furnace control. This story is important to you.

It has been proved that with proper burners and furnace design highly preheated air can be used to advantage in air furnace operation. On the basis of present day costs and operation, a Carborundum Company Recuperator on your furnace will pay for itself in a year or less.

Are you interested? Call or write our nearest office for further information.

THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.
REFRACTORY DIVISION
PERTH AMBOY, N. J.

District Sales Branches: Boston, Chicago, Cleveland, Detroit, Philadelphia, Pittsburgh. Agents: McConnell Sales and Engineering Corp., Birmingham, Ala.; Calvin M. Christy, St. Louis; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Co., Los Angeles, San Francisco, Seattle; Denver Fireclay Co., El Paso, Texas.

(Carborundum, Carbofrax, Alfrax and Mullfrax are registered trade-marks of The Carborundum Company)

REFRACTORY • CARBORUNDUM REG. U.S. BRAND PAT. OFF. PRODUCTS

AMERICAN GAS FURNACE CO.
PIONEERS IN 1878
LEADERS TO-DAY

MODERN HEAT TREATING EQUIPMENT

for

GAS CARBURIZING
CLEAN HARDENING
CLEAN ANNEALING
CLEAN NORMALIZING
TEMPERING
"NI-CARB"

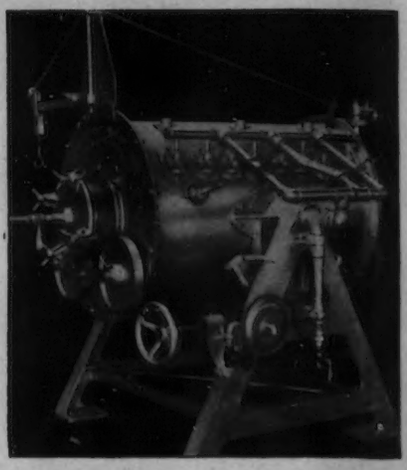
The importance of atmosphere control has long been recognized by us. As far back as 1902 our rotary continuous machines were provided with a special burner to achieve this very purpose.

May we tell you more about our original developments and latest designs.

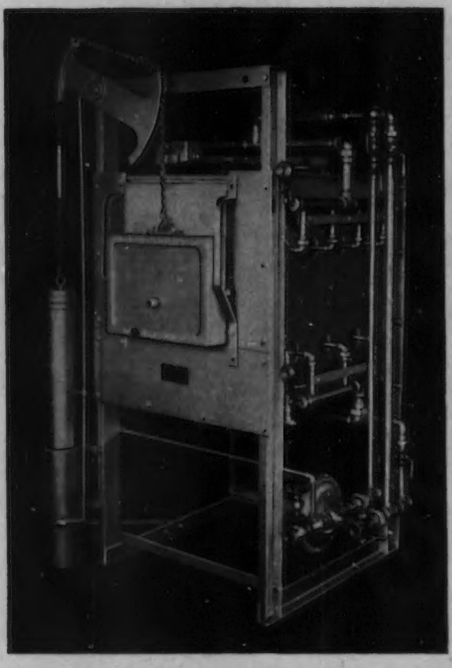
Our latest development will be shown at the

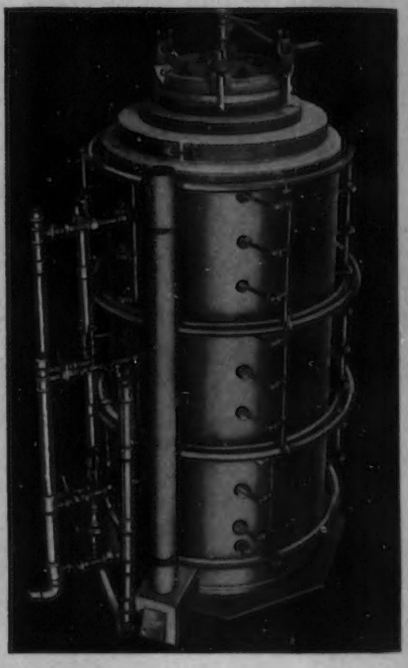
A.S.M. Exposition.
Atlantic City, Oct. 18 to 22

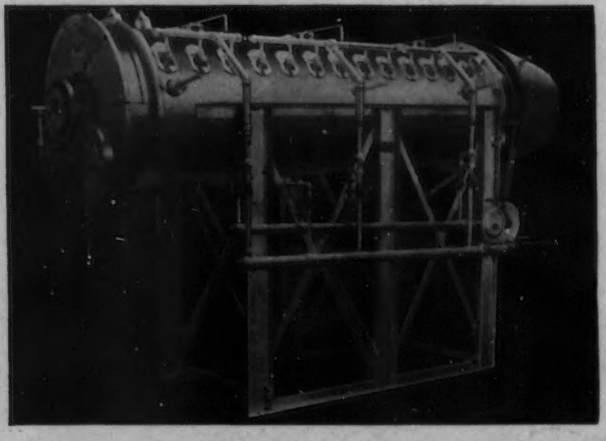
● (Right) Atmosphere control in this machine recommends it for clean hardening and annealing, etc., as well as quality carburizing at minimum cost.



● (Below) Atmosphere control in this Oven Furnace of advanced design gives clean hard work.







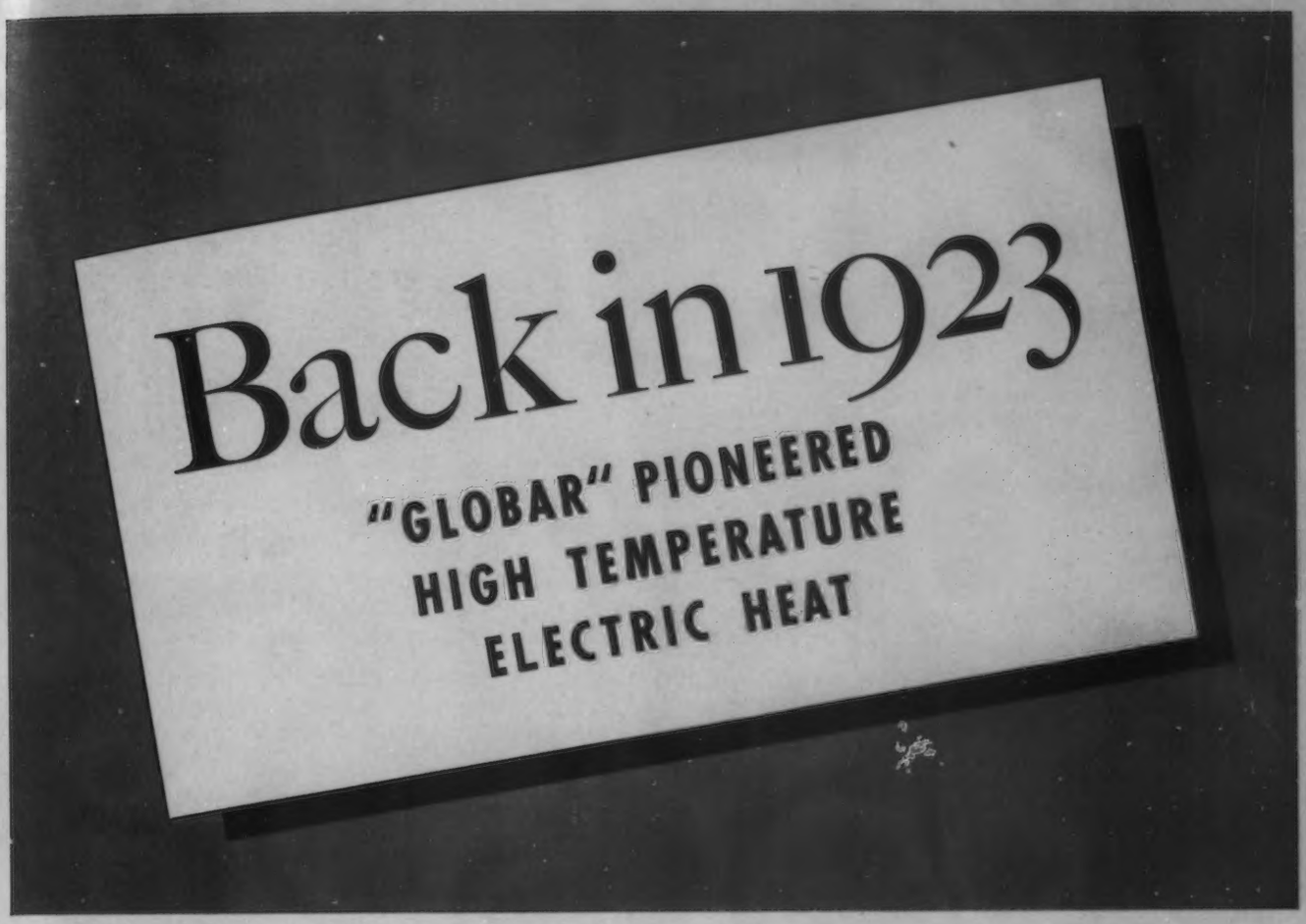
● (Above) Any desired atmosphere can be carried in the retort of this Vertical Furnace for annealing, hardening and gas carburizing with high quality and low labor and overall cost.

● (Left) Atmosphere control in this continuous rotary produces highest quality work on a tonnage basis with low labor and overall cost.

American Gas Furnace Co.

Elizabeth, New Jersey

Engineering Representatives in Principal Cities

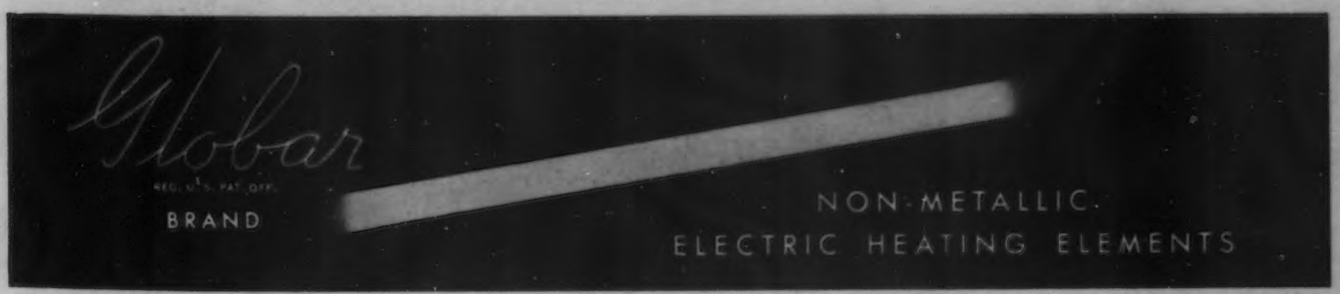


Today "GLOBAR" STILL LEADS THE FIELD

• High temperature electric heat is nothing new to "Globar" users. They've had it ever since 1923. Thousands of furnaces have proved the value of non-metallic, electric elements for high temperatures.

Long experience in the high temperature heating field has made "Globar" the leader. Thousands of installations have proved the success of Globar Brand Non-Metallic High Temperature Electric Heating Elements.

Let Globar engineers and technicians help solve your heating problems. A representative will be glad to give you more specific information. Write, phone or wire our nearest office.



GLOBAR DIVISION

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

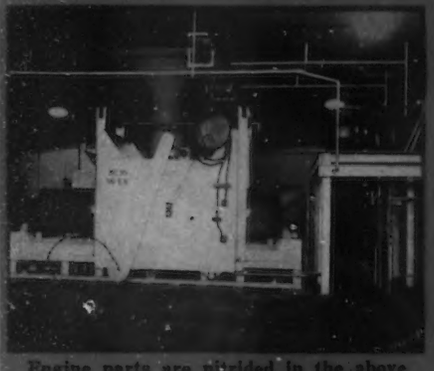
Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids

(Carborundum and Globar are registered trade-marks of The Carborundum Company)

LET US SHOW YOU

Bright Annealing Steel Tubing—continuously—5 to 25 foot lengths—2,000 pounds per hour.

Metal Radio Tube Parts are copper brazed and bright annealed continuously in furnaces of the above type.



Engine parts are nitrided in the above semi-continuous furnace—one of several similar installations.

Brass, Bronze and Copper in wire and strip are annealed continuously in this special atmosphere furnace.

At Atlantic City

While you are attending the National Metal Exposition at Atlantic City —October 18-22—permit us to show you some furnace installations we have made in that vicinity. Several of these are shown at left and below.

See also the large display of photographs and drawings of outstanding electric and fuel fired furnace installations in our booth (D-80—directly in front of stage). The latest developments in special atmosphere equipment for bright and clean annealing various ferrous and non-ferrous products including tubing, wire, strip, sheet, stampings and other finished and unfinished products are shown in this display.

These pictures also show some of our new continuous furnaces for copper brazing, bright hardening and heat treating with complete absence of scale, as well as other continuous and batch furnaces of various types for normalizing, annealing, forging, billet heating and other heat treating processes.

See the large display of actual parts and products handled in these furnaces.

See the Elfurno generators for producing the inexpensive, protective atmosphere used in our controlled atmosphere furnaces.

See the new gas fired recuperative type radiant tube—the most uniform and the most economically operated radiant tube yet developed.

See the heavy cast metallic heating elements—the heaviest and most rugged element used in industrial furnace heating.

Our engineers will be glad to show you this equipment or work with you on any of your furnace or heat treating problems.

The Electric Furnace Company

Hotel Headquarters during Exposition
THE AMBASSADOR HOTEL

Salem, Ohio

Exposition Headquarters Booth D-80 (directly in front of stage)

Aircraft Motor Castings and other parts are heat treated in the above circular pit type electric furnace.

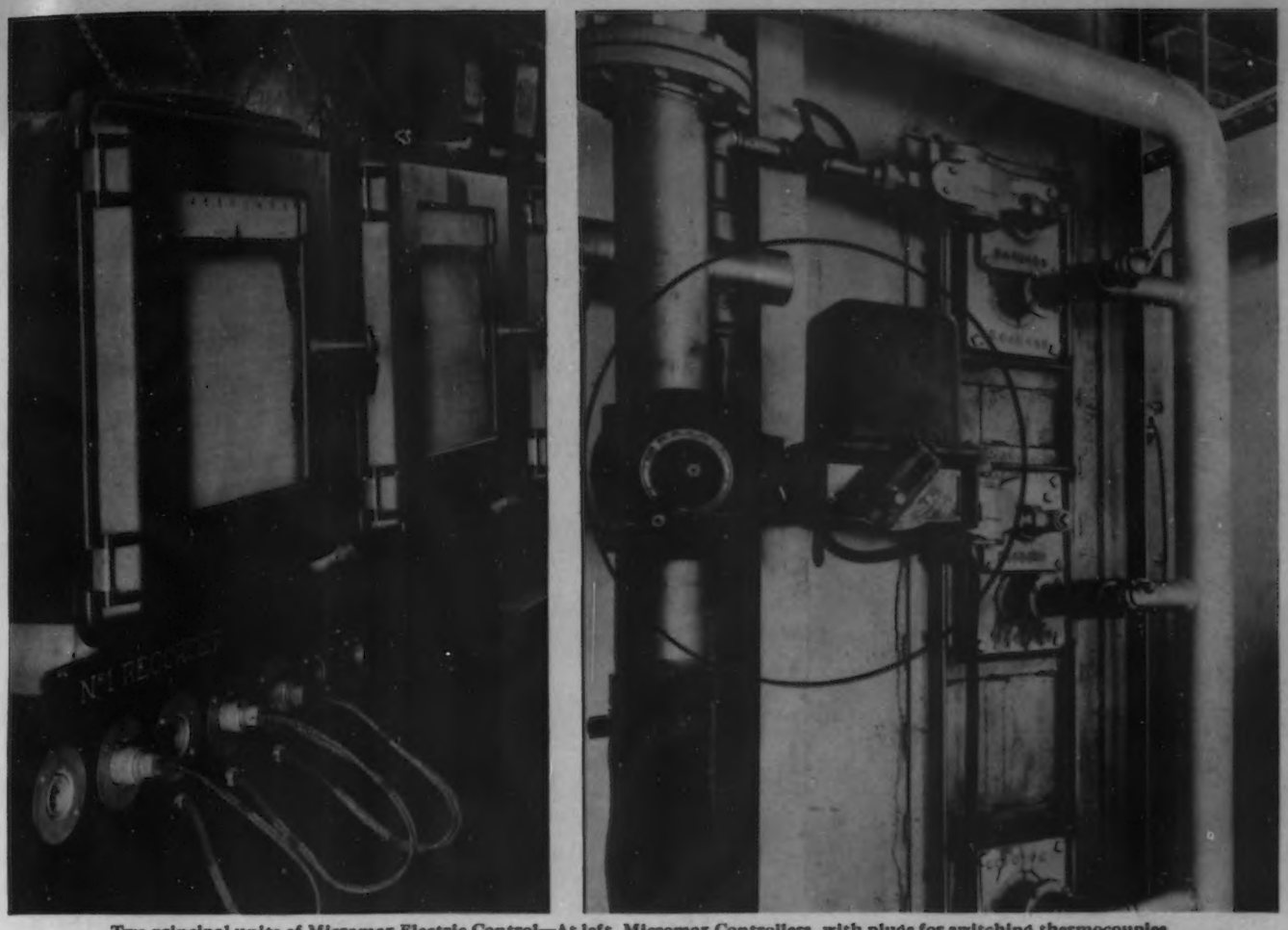
Gas Fired Radiant Tube Furnace equipped for special atmosphere for bright annealing copper tubing.

THE ELECTRIC FURNACE CO.

Fuel Fired Furnaces

SALEM, OHIO

Electric Furnaces



Two principal units of Micromax Electric Control—At left, Micromax Controllers, with plugs for switching thermocouples to any desired furnace. At right, Drive Unit on a cover-furnace gas valve.

FOR *Any* FURNACE . . .

MICROMAX ELECTRIC CONTROL

With component parts exactly matching the Micromax Pyrometer in sensitivity and dependability, Micromax Electric Control makes available from couple to valve drive all the qualities that Micromax users associate with that Recorder. And—this Control fits any furnace, from blast furnace to small box-type unit. It can be standard for an entire plant—bringing big-furnace dependability to the regulation of small furnaces, and small-furnace simplicity to the big units.

At the Metal Show
See Micromax Instruments, Vapocarb-Hump & Homo Furnaces

LEEDS & NORTHRUP COMPANY, 4956 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

JNA(5)

A NEW PROCESS

at
Atlantic City
Booth No. B-32

¶ THIS PROCESS is a product of Holden Research which has required more than two years of study and development.

¶ IT APPLIES to operations which range in temperature from 1500° to 2500°F, where work free from scale and decarburization is a problem.

¶ EQUIPMENT can be fuel fired or electric electrode.

¶ ASSURED SAVINGS of 10 to 30 per cent.

¶ NO SCALE, Maximum Hardness.

COME——
LOOK——
AND BE
CONVINCED

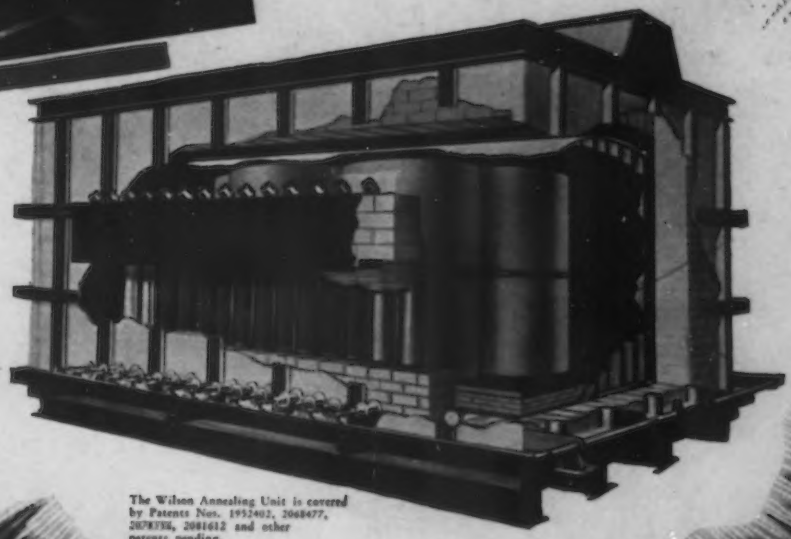
Reduces Processing Time 50 *per cent*

HOLDEN Baths

A. F. HOLDEN COMPANY
NEW HAVEN, CONN.
Developers of Heat Treating Baths

To Produce a HIGHER QUALITY TIN PLATE AT A LOWER COST . . .

Install WEAN Continuous Strip Pickler, HALDEN Rotary Flying Shears and WILSON Annealing Furnaces

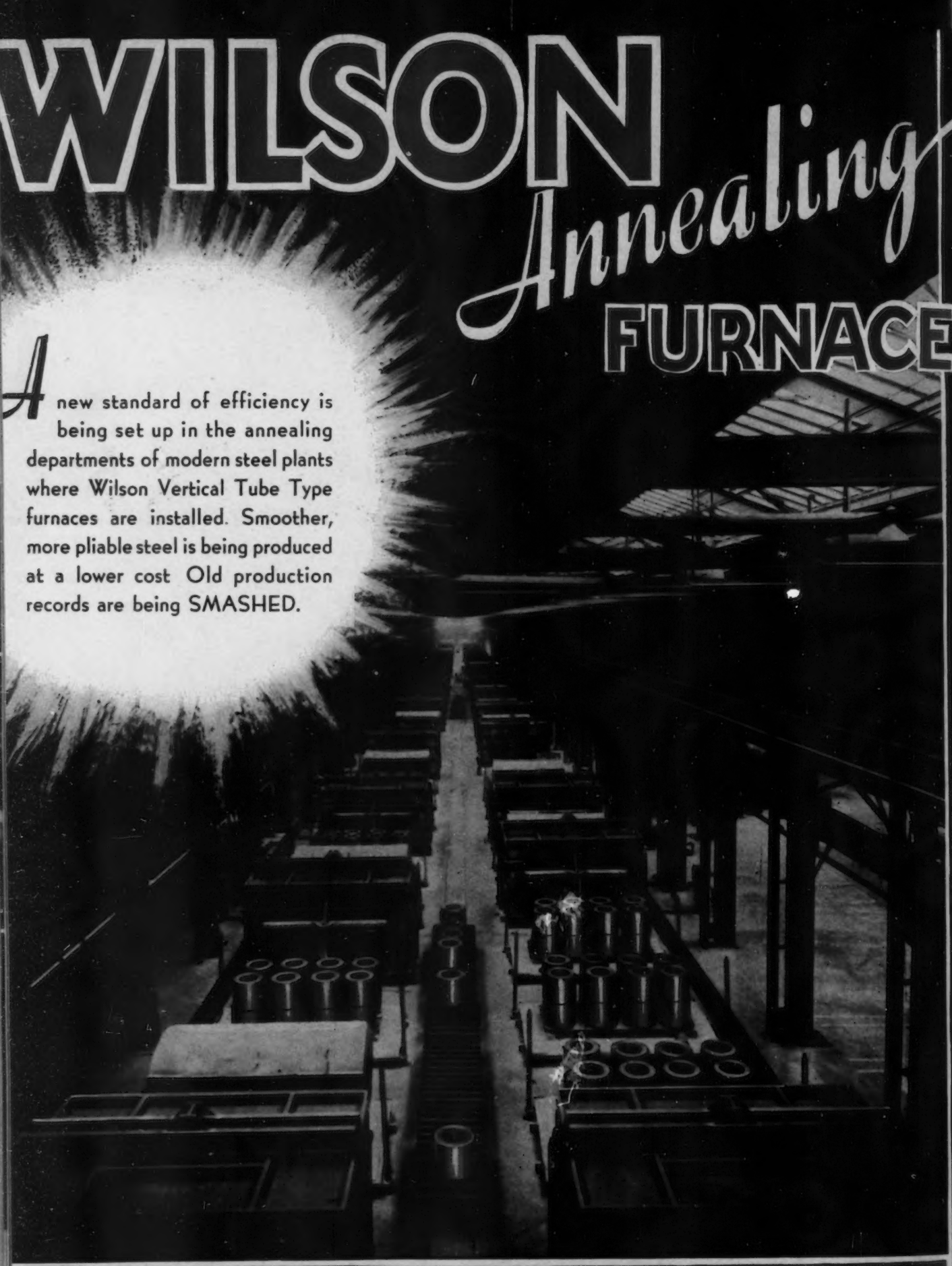


The Wilson Annealing Unit is covered by Patents Nos. 1952402, 2068477, 2078358, 2081612 and other patents pending.

THE WEAN ENGINEERING CO., INC.
WARREN, OHIO

WILSON *Annealing* FURNACES

A new standard of efficiency is being set up in the annealing departments of modern steel plants where Wilson Vertical Tube Type furnaces are installed. Smoother, more pliable steel is being produced at a lower cost Old production records are being SMASHED.



THIS shows a partial view of an installation in a large midwestern steel plant in which there are over 90 Wilson Annealing furnaces.

An Exclusive Development of

LEE WILSON ENGINEERING CO.

1270 Blount Street • Cleveland, Ohio

WELCOME to the

QUIGLEY EXHIBIT

At Booth H-74

NATIONAL METAL SHOW

ATLANTIC CITY . . . OCTOBER 18 to 22, 1937

On display:—INSULBRIX, INSULBLOX, INSULAG AND INSULCRETE — extraordinary developments in light weight, low heat storage insulating refractories . . . effecting sensational economies in metal production, forging and heat-treating. Learn how they slash fuel and labor costs . . . boost output . . . speed-up production.

QUIGLEY PRODUCTS: INSULBRIX · INSULBLOX · INSULAG · INSULCRETE · HYTEMPITE Q-CHROME · Q-CHROMASTIC · SPECIFICATION FIRE BRICK · MONO-LINE · ACID-PROOF CEMENTS HEARTH-CRETE · CAST-REFRACT · TRIPLE-A PROTECTIVE COATINGS · Q-SEAL · DAMIT · ANNITE

QUIGLEY COMPANY, INC.

56 W. 45th Street, New York, N. Y.

Makers of* HYTEMPITE, *"The World's Standard High Temperature Cement"

Distributors with Stocks and Service in Important Industrial Centers throughout the United States, Canada, and in 32 other countries. In Canada, Quigley Company of Canada, Limited, Lachine, P. Q.

THE IRON AGE

A Chilton Publication

TWO-THIRTY-NINE W. THIRTY-NINTH ST.
NEW YORK

October 14, 1937

TO THE ADVERTISERS
IN THIS ISSUE:

Gentlemen:

Now that you have a copy of this issue in your hands we believe you will agree that with your cooperation we have produced a really noteworthy National Metal Exposition Issue.

The sectionalized arrangement of the Insert, designed primarily for the convenience of the reader, also adds to the effectiveness of the advertising, since the editorial articles dealing with developments in important lines of metal-working activity, and related advertising are grouped for the quick reference of those most interested in these various subjects.

It is worth noting that this National Metal Insert carries a greater volume of advertising than any similar insert we have ever published.

Naturally, this is gratifying to us since The Iron Age pioneered in publishing insert sections in color in connection with the Steel Treating Exhibitions which preceded the present National Metal Expositions.

This record breaking insert is also most encouraging as a measure of your confidence in the future.

Very truly yours,

THE IRON AGE

C. S. Baur

GENERAL ADVERTISING MANAGER

C. S. BAUR

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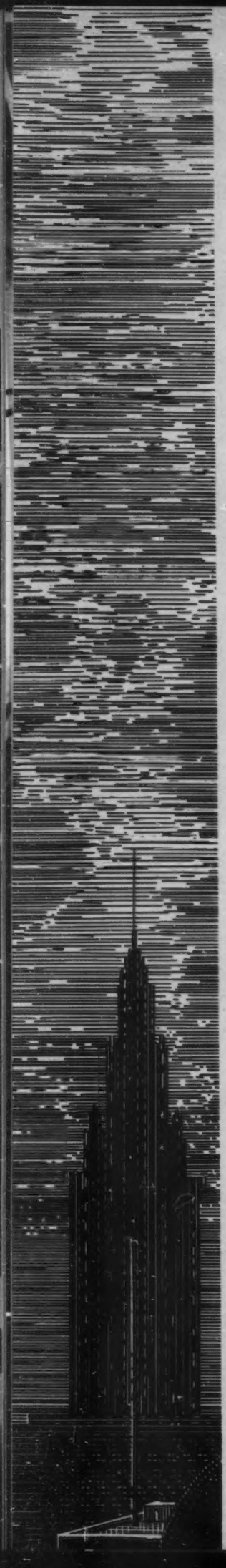
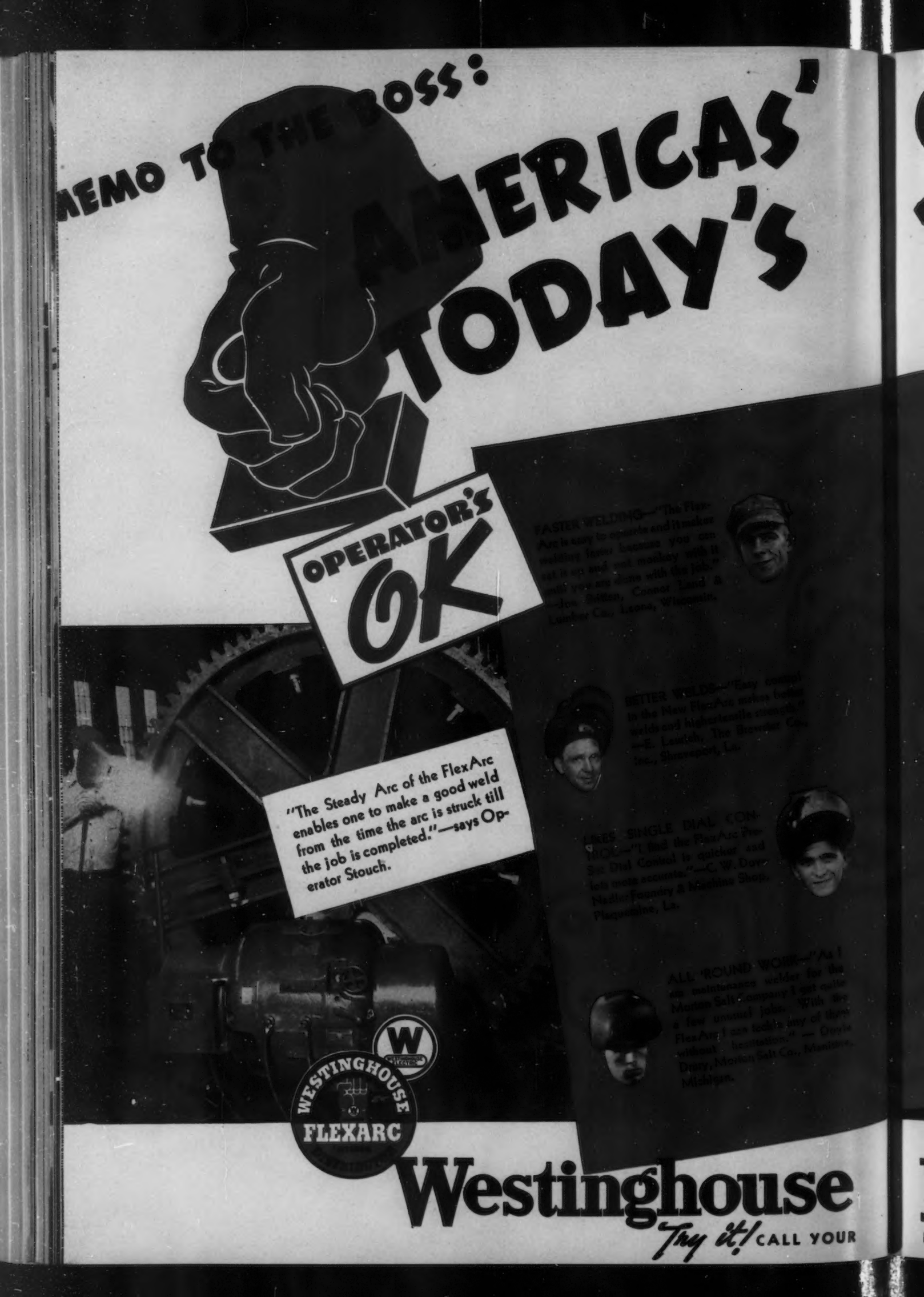


WELDING AND CUTTING

SHORTLY after Sir Humphry Davy in 1810 discovered the electric arc, he suggested the interesting laboratory experiment of welding two metals together by an electrical discharge. Any development even approaching a commercial scale, however, had to wait until 1877, at which time the genius of Professor Elihu Thomson was first directed to the utilization of electricity in this manner by the joining of two wires in the course of experiments in Philadelphia. From then on the time-honored hammering process died rapidly as the virile new techniques, electric and gas welding, surged into new territory to challenge rivets, bolts, foundry castings and even the steel mill itself, while at the same time, an offspring, gas cutting, challenged the metal saw, the shear and the machine tool.

Today, welding stands proud of its accomplishments and its possibilities. In fact, welding's technical advance has been more rapid than the education of customers to the economic and physical advantages inherent in this type of fabrication. What welding has done, what it is able to do and how it should be done, are all explained in interesting and easily understood terms in the following article, the author being one of the few men best able to interpret this twentieth-century science, a man who has designed and welded some of the most complex of modern machines.

C.MEHNER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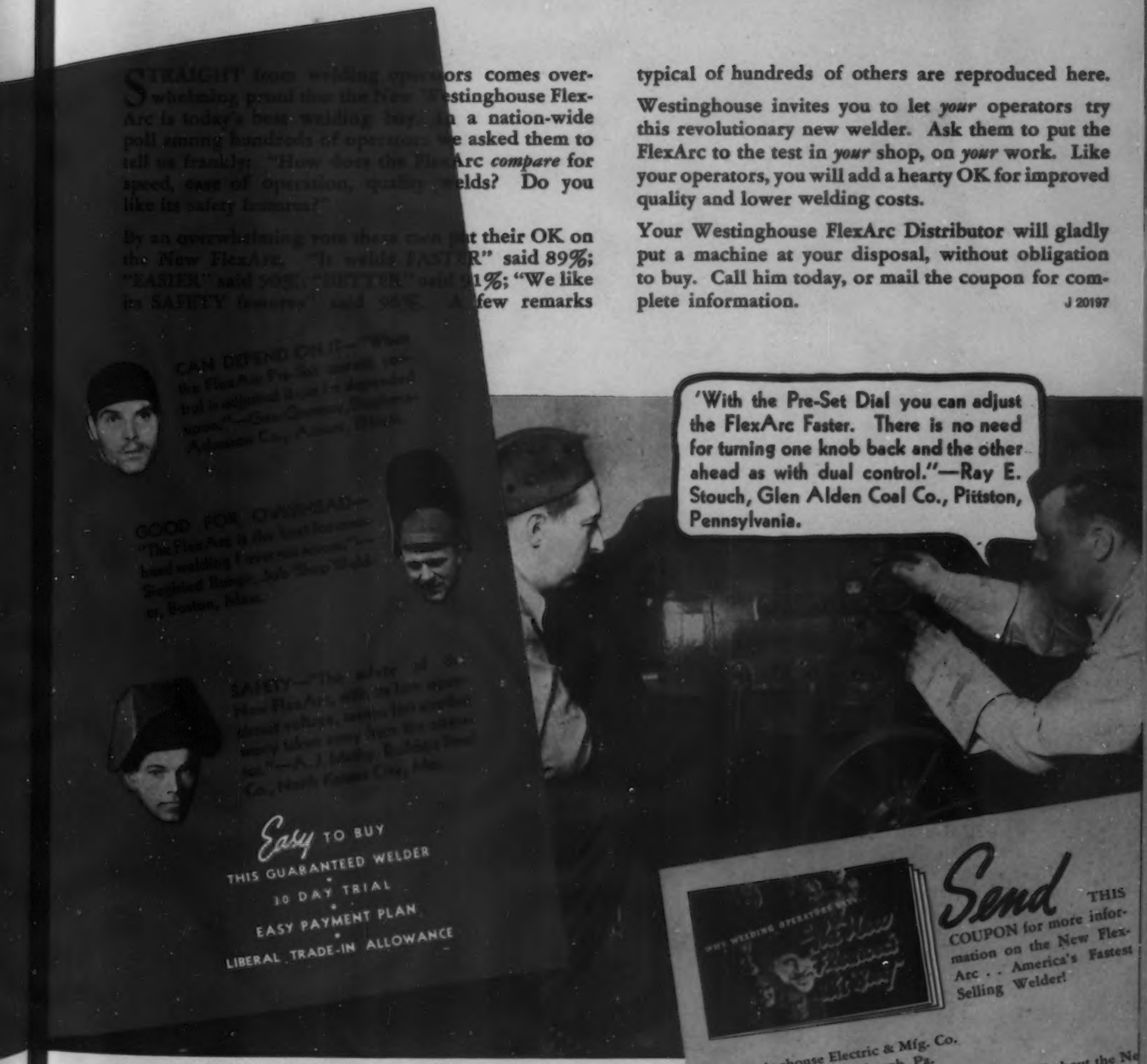
STRAIGHT from welding operators comes overwhelming proud that the New Westinghouse FlexArc is today's best welding buy. In a nation-wide poll among hundreds of operators we asked them to tell us frankly: "How does the FlexArc *compare* for speed, ease of operation, quality of welds? Do you like its safety features?"

By an overwhelming vote these men put their OK on the New FlexArc. "It welds FASTER" said 89%; "EASIER" said 90%; "SMOOTHER" said 91%; "We like its SAFETY features" said 96%. A few remarks typical of hundreds of others are reproduced here.

Westinghouse invites you to let *your* operators try this revolutionary new welder. Ask them to put the FlexArc to the test in *your* shop, on *your* work. Like your operators, you will add a hearty OK for improved quality and lower welding costs.

Your Westinghouse FlexArc Distributor will gladly put a machine at your disposal, without obligation to buy. Call him today, or mail the coupon for complete information. J 20197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WELDING of MECHANICAL EQUIPMENT

By ALFRED E. GIBSON*

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THE Wellman Engineering Co. is often asked the question, "Why do you make it of welded construction?" The answer is seldom, "Because it is cheaper," but more often, "Because it is stronger, lighter, less expensive to operate, has a lower upkeep, a longer life, and is more resistant to corrosion or abrasion."

To the engineer and fabricator the question of cost is vital; vital, because of the necessity of competing for business, and vital to the purchasing agent whose function is to buy to the best advantage and who generally does an efficient job of it. Most of the work built of welded construction actually costs less than if it were of cast design, yet a considerable amount of welded sales bring greater prices than those of castings. This is so because it has more to offer, advantages not possible in cast equipment. It is surprising the number of instances in which both welded and cast designs are offered that the former, at considerably higher prices than the latter, are chosen by the purchaser who is willing to pay the higher price to obtain certain advantages found only in welded construction. If either welded or cast design is satisfactory for the service intended, the buyer is faced solely with the question of price, and, naturally, chooses the type of fabrication which is most economical.

It is possible, in many instances, to build into welded details greater strength with the same weight than can be obtained with castings, or it is possible to considerably reduce the weight while maintaining the same strength. The former instance is always an advantage, and the latter is a decided advantage in moving mechanisms where power is consumed to accelerate heavy loads. Take, as an example, welded gear reduction cases; these can safely be reduced in the metal sections from 10 to 20 per cent under that required for castings. In addition, further savings in weight can be made in welded designs by doing away with fillets joining walls in different planes, and, particularly, where thin and thick sections are

* President of the American Welding Society, and president of the Wellman Engineering Co., Cleveland.

generally used in castings. Weight is reduced to an almost unbelievable extent where the newer high-strength alloy steels are used. Thirty, 40 and even 50 per cent weight reductions are possible by using these materials in new designs, particularly in those instances where constructive study has been made of the proper distribution of metal. Further mention of these strong alloy materials will be made later in this article.

Those who have given careful thought to the matter of welded design agree that the future growth and development of welding depends, in a large measure, on the ingenuity of designers, their knowledge of welding, of metallurgy, and their appreciation of the importance of eliminating as much welding as possible in the fabrication of welded parts. Welding is not a cheap operation. We know that a welding hour costs at least 30 per cent more than most classifications of labor in a steel fabrication shop. Thus, it is perfectly logical that additional thought should be given to the study of reduction in welding time. To weld two plates to form an angle is much more costly than to bend one plate to form that shape. Welderies have not yet universally learned the advantages of the plate bending brake. When they do, the manufacturers of this type of tool will be swamped with orders. Fig. 1 illustrates this point admirably. Here is shown a half inch plate, 11 ft. 2 in. long, being bent into a channel shape. The two operations take but a few minutes. Compare this with the time which would be required with the fastest automatic method known to weld the part using three separate plates. With the use of a plate brake, a steel plate can be inexpensively shaped to obtain the maximum stiffness and rigidity, thus making possible the use of the minimum amount of metal. An example of this is the corrugation of freight car ends and doors, which has been in general use for years.

FIG. 1—The use of a plate bending brake, as illustrated here, bending a ½-in. plate 11 ft. 2 in. long, makes possible a great saving in cost over welding three plates to form the shape. It is such equipment as plate brakes that is playing an important role in cost reduction of welded equipment. Note that the brake is itself 100 per cent welded construction.

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The same effort to reduce costs is shown in Fig. 2. In this instance a transfer car used in the glass industry has been fabricated, using rolled sections such as angles, channels and beams. It has been learned that rolled shapes may be incorporated into welded designs, not only materially lowering the required welding hours, but also obtaining superior strength and rigidity. One would have to look far these days to find bed plates for large electrical drives which

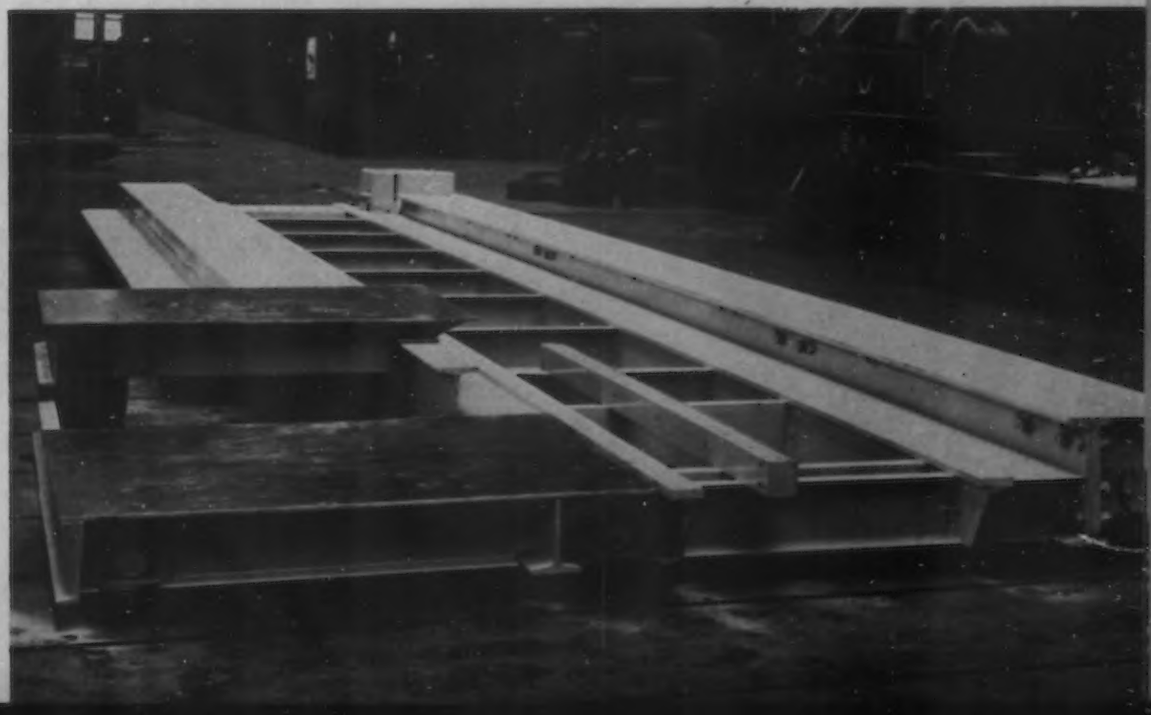

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FIG. 2—Welded transfer car, illustrating the use of rolled angles, channels and beams in the construction of equipment of light weight.

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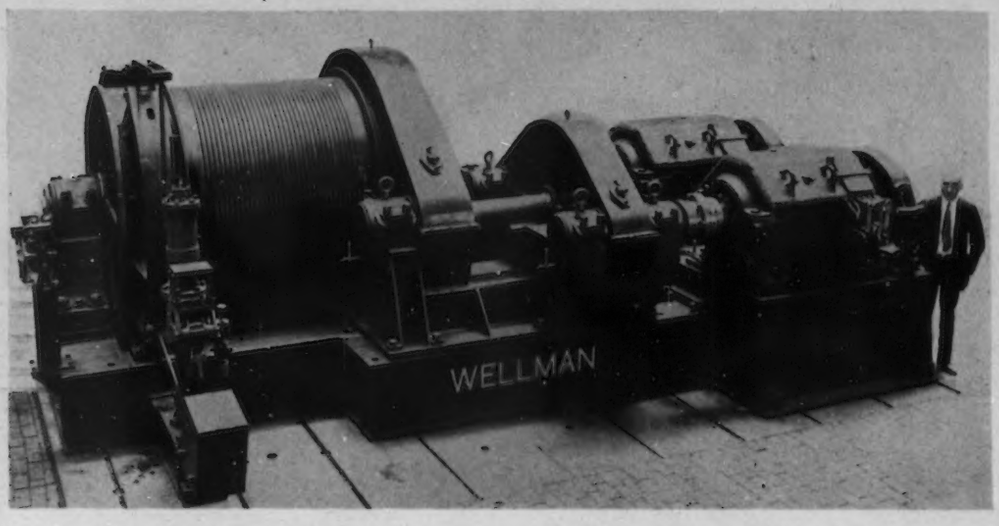

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FIG. 3—A welded design blast furnace skip hoist weighing approximately 90,000 lb. The bed plate is of heavy wide-flanged beams, and the gear reduction case has cast steel bearings welded to the plate.

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are not constructed of heavy beams welded to plates, forming a unit of light weight and highly satisfactory stiffness and rigidity. The advantages of the use of such efficient sections as the beam, the box and the cylinder has been learned; not that this has not been known for years, but welding has made engineers more conscious of their advantages than they were with cast designs.

Castings Welded to Rolled Steel

Another method of construction which has come into wide use is the combination of rolled steel and steel castings. Practically all large welded gear reduction cases are now designed using cast steel bearings welded to steel plate. Parts, costly as forgings or gas cut details, are made in castings, and are not only satisfactory in service but make for lowered cost. Usually these bearings are simple in design, made from a pattern which may be cut out on a band saw and not requiring core boxes. If we could bring into practice some kind of a New Deal law requiring every mechanical draftsman to spend a three year apprenticeship in machine and welding shops, the cumulative savings made in the cost of building America's mechanical equipment, as a result of their practical experience, would finance another half dozen national Administration alphabetical spending agencies.

Fig. 3, a blast furnace skip hoist, not only illustrates the combination of steel castings and plate comprising the herringbone gear reduction case, but also the use of heavy wide flange beams forming the bed plate of the machine. The post brakes, brake arms and counterweight, as well as speed control and safety device, are also of welded construction. The herringbone gear reduction case has ring oil bearings of cast steel welded to steel plate, after which the entire unit was stress relieved at 1200 deg. F. While the necessity of the heat treatment might be questioned, it was made as an added safety factor to eliminate any possibility of distortion in service which might produce uneven and dangerous tooth loading.

The successful welding fabrication of heavy equipment is so dependent upon the gas cutting torch that costs would be materially increased without its use. Plates of too heavy thickness to be sheared can be cut cheaply with gas. Irregular shapes not suitable for mechanical cutting are inexpensively made with the torch. The newer gas cutting equipment utilizing cams, templets, magnetically guided cam rollers and multiple torches has revolutionized the speed and accuracy of cutting operations. Gas cut surfaces closely approximating machined surfaces are easily obtained with positive guiding of the torch. No welding shop can afford to be without a cutting machine even though it be but one of the small, light weight type which can be purchased for less than $200.

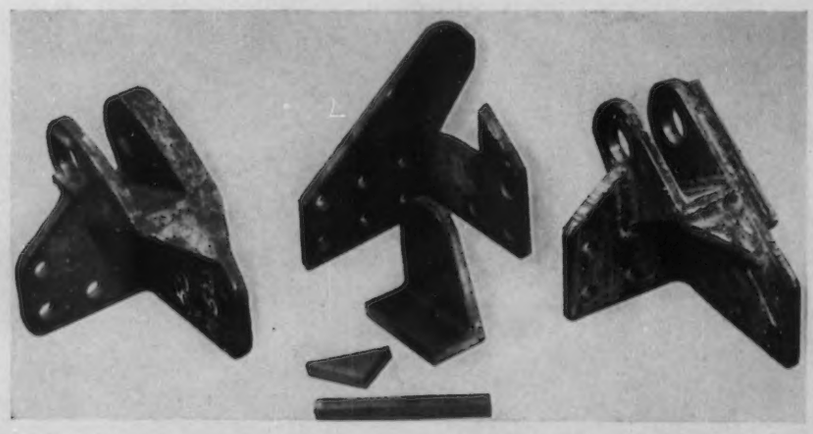

FIG. 4—The corner bracket at the left is an original design in cast steel. The one at the right is a development in welded construction. No failures of the welded design have ever occurred, and its cost is 40 per cent under the price of castings.

Fig. 4 is an example of the advantage of gas cutting. The part at the left is an older design of cast steel corner bracket. The one at the right is a new design in welded construction, and the detail parts entering into its construction are shown between the two units. These brackets are made in lots of 50 or 100, and, in computing the savings, no account of the pattern cost has been considered. The reduction in cost in favor of weld-

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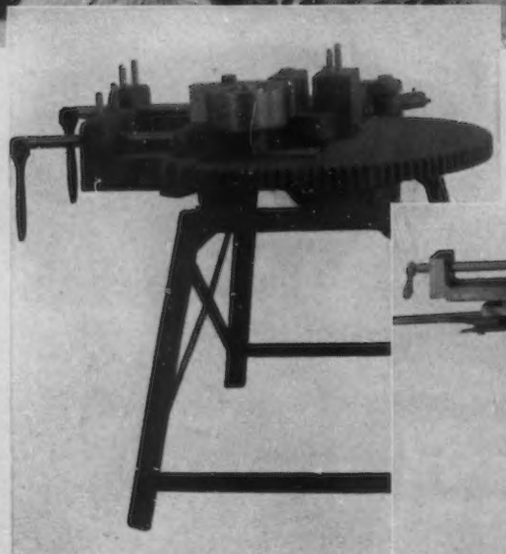
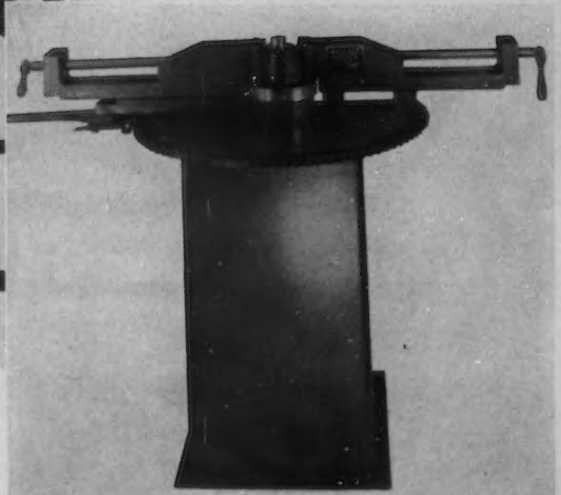




Saved $28 on the Rack Top Plate Alone—*Redesign of this bar bending machine cut costs on every part. The rack top plate alone was reduced from $60 to $32. The weight of the machine was reduced from 1250 lbs. to 736 lbs. The welded machine can be operated by one man whereas the old one required two men. And note how the appearance has been improved.*

Courtesy of Wallace Supplies Mfg. Co., Chicago, Ill.

The Welded Treadle Costs 45c Less—*Built from a piece of 2-inch channel and a checkered plate, this welded foot treadle costs only 73 cents—38% less than the old design. In addition, the welded part is unbreakable.*

Courtesy of Jones Superior Machine Co., Chicago, Ill.

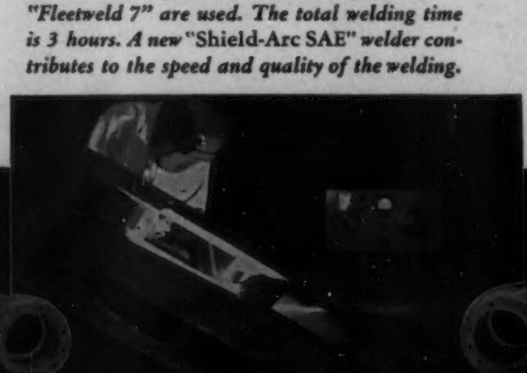
This Change-Over Yielded 88c Per Part—*This cast iron sheave housing for a gas reducing valve was changed to welded design, using standard steel shapes. Cost was reduced from $2.65 to $1.77.*

Welded Steel is Stronger—This Manufacturer Proved Its Superiority by Actual Destruction Test

Supported at both ends and loaded at the center, the cast steel design shown below failed at 61,760 lbs. Under the same set-up, the welded steel design shown at the right withstood a loading up to 105,000 lbs. The weight and cost of each is practically the same.

This test was made by the Athey Truss Wheel Co., Chicago, to prove the superiority of their new welded rocker beam for "Forged-Trak" wheels.

The welded design employs 5/16" pressed steel stampings as the main members. Hubs are cast steel. The part is welded in a positioning jig so that all welding is downhand. Two passes of 1/4" "Fleetweld 7" are used. The total welding time is 3 hours. A new "Shield-Arc SAE" welder contributes to the speed and quality of the welding.



THIS MANAGER, FIRMLY CONVINCED THAT WELDED DESIGN WILL CUT COSTS AND IMPROVE THE PRODUCT, IS *BOUND* TO INCREASE THE PROSPERITY OF HIS COMPANY

Today, countless manufacturers of iron and steel products are more firmly established and are enjoying good fortune because of one lone individual in the organization—an enthusiast for welded design.

This engineer or manager wages a determined drive to apply welded fabrication to *every* product which his company manufactures. He succeeds because he stands by his guns. If first attempts fail, he tries again...and again. He believes in welding because—

HE KNOWS that rolled steel costs ⅓ to ½ as much as the traditional material.

HE KNOWS that welded fabrication eliminates pattern costs.

HE KNOWS that welded steel designs are from 2 to 6 times as strong as the cast designs which they replace.

HE KNOWS that welded steel construction permits the use of steels of various types and that they can be combined in a part to give any desired service qualities.

HE KNOWS that welded steel permits greater freedom on the part of the designer to improve the appearance of the product.

HE KNOWS that the more welding he can put in his shop, the more he will absorb his company's fixed charges.

HE KNOWS that his Company will profit.

You, too, will profit by designating some experienced, strong-willed individual in your organization to make welded design pay the dividends that it does pay.

You can start welding easily and with little investment in equipment because you can change over one part at a time. May we be of assistance to you? THE LINCOLN ELECTRIC COMPANY, Dept. X -426, Cleveland, Ohio.

$4.39—Cost of this cast steel bracket for a shovel bucket.
The welded design uses standard steel shapes, cut and formed as shown.
$2.95—Cost of the new welded steel bracket.

THE LINCOLN ELECTRIC COMPANY
Dept. X -426 Cleveland, Ohio

Send the FACTS about welded design.

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FIG. 5—The clean-up coal bucket with 9-ft. wide scoops and 24-ft. spread shown here is constructed of Man-Ten, a low-alloy high-strength steel with excellent abrasion resisting qualities. All details, with the exception of the main frame, which is unsuitable for heat treatment, are of welded construction. This is a splendid example of low-weight and high-strength obtainable with the newer low-alloy steels.

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ing over castings amounts to 40 per cent.

The bracket consists of a plate, torch cut as shown, bent to a right angle, and the holes punched for rivets. A heavy rolled angle is sheared and gas cut, a triangular bracket sheared and the three pieces assembled in a fixture for welding. This is but one example of thousands of details now made in castings which can be made of rolled steel, gas cut, sheared and welded at greatly reduced costs, as compared to castings. The Wellman company recently encountered a quantity of newly designed sheave supports weighing 25 lb. each, which were produced by shearing, gas cutting and bending plate. The cost was 25 per cent under that of its predecessor in cast iron. Of course, a great reduction in weight was made; the older design, of years standing, was 33 per cent heavier. This is one of many examples which might be cited to show that thought put into design because of interest in welding may produce outstanding results.

One of the chief advantages of welded design is that it inspires constructive thought to produce a better, cheaper product. The only reason more of this kind of work is not done is because too many engineers are in a designing rut, without sufficient ingenuity or incentive to do constructive thinking. Too often, engineers are wedded to their past experience and methods of construction. There was recent-

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FIG. 6—The part shown in this picture is the upper sheave block forming a part of the bucket shown in Fig. 5. Using Man-Ten steel, with complete penetration welds and heat treated to eliminate air hardening, this design made possible a substantial saving in weight over that of a casting.

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OXWELD* SHAPE-CUTTING MACHINES

. . . *production tools for shaping steel*

See the new Oxweld CM-12 Cutting Machine in operation at the Linde Exhibit Booth H52 National Metal Show Atlantic City, N. J. October 18-22, 1937

AUTOMATIC repetitive cutting of steel parts on a production basis can be accomplished quickly and economically with any one of the new and improved Oxweld oxy-acetylene shape-cutting machines.

For example, the stationary Oxweld CM-12—one of a complete line of portable and stationary machines—is unexcelled in precision for automatically cutting intricate shapes on a large-scale production basis. The CM-12 will perform multiple cutting operations using up to five blowpipes at one time. This machine can also be used for fabricating specialized equipment profitably, even when only one piece is required.

A Linde representative will gladly explain how flame cutting can help lower your manufacturing costs by improving cutting accuracy and speeding up production. Ask for complete information today. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.

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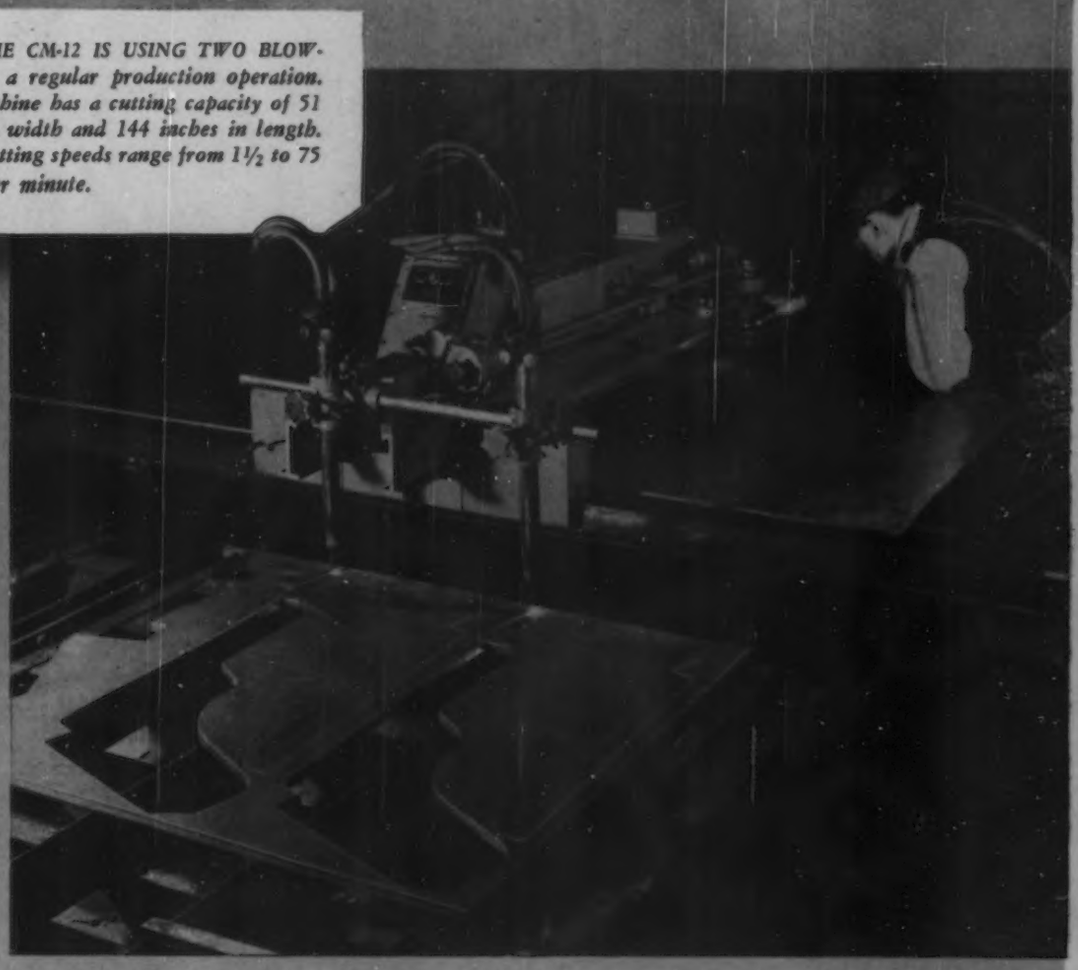

HERE THE CM-12 IS USING TWO BLOWPIPES in a regular production operation. This machine has a cutting capacity of 51 inches in width and 144 inches in length. Lineal cutting speeds range from 1½ to 75 inches per minute.

Everything for Oxy-Acetylene Welding and Cutting

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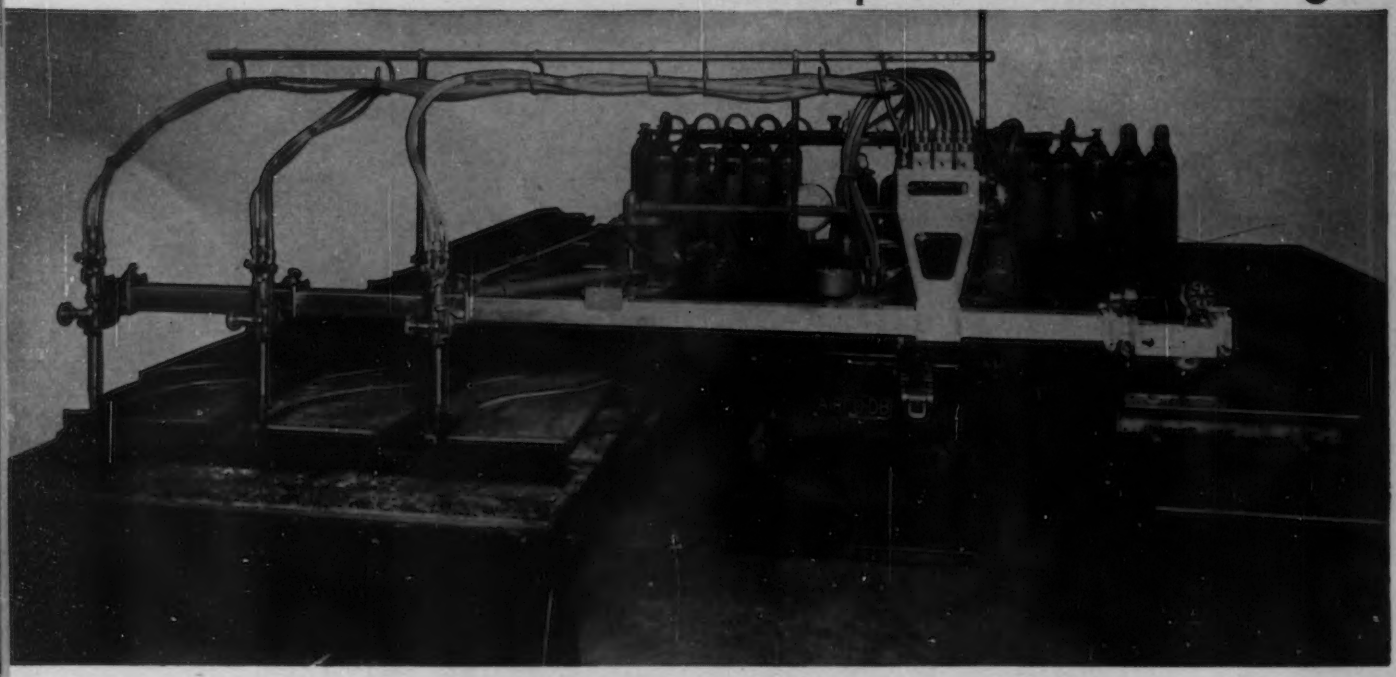
The AIRCO-DB TRAVOGRAPHS

Broadening the range of Multiple Flame Cutting



These new AIRCO-DB gas cutting machines will cut steel accurately and economically over a cutting area of 120 inches wide by 13 feet long. The length can be increased indefinitely by the use of additional track. A mechanically operated magnetic tracer —*an exclusive AIRCO feature*—guides the bar upon which the torches are mounted, cutting duplicate parts with speed and accuracy. Other guiding devices for template or manual operation can also be supplied.

As with the AIRCO-DB No. 6 Oxygraph, these machines make multiple torch cutting a *practical* operation.

Another triumph for AIRCO engineering skill—another opportunity to reduce costs in production of parts gas cut from steel.

Be sure to visit the AIRCO exhibit at Atlantic City where these and other AIRCO-DB gas cutting machines will be operating on standard production work.

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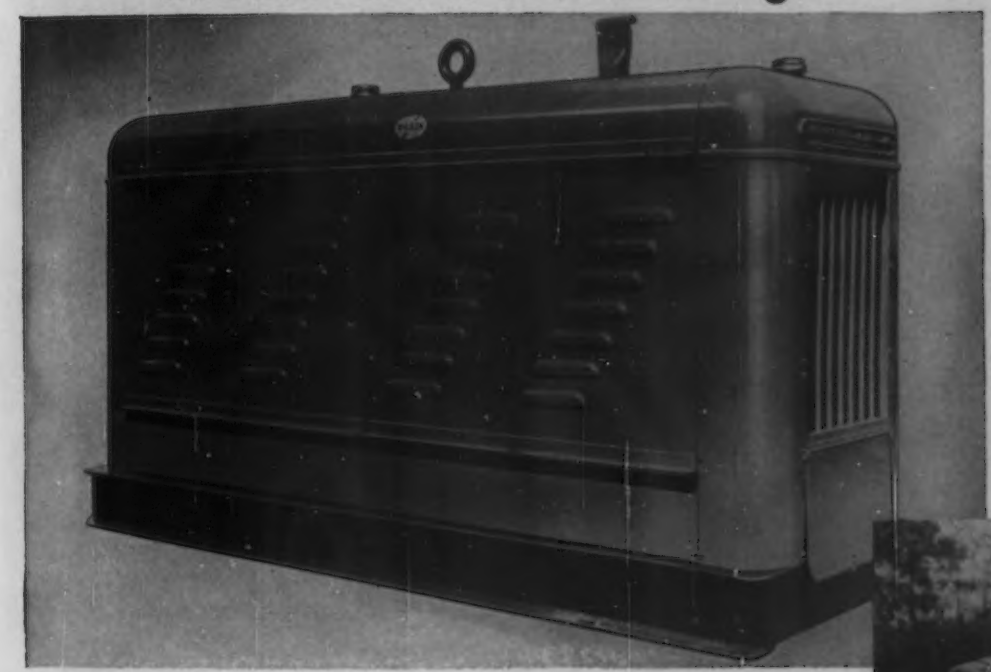

Specifically designed and developed to meet the difficult conditions often encountered in PIPE LINE welding. Important features include: light weight—rigid strength—low center of gravity—improved automatic idling device—large gasoline tank—close coupling of drive and generator. Many other features covered in the complete catalog—on request. You can depend upon it to get sound welds at rock bottom cost from start to finish of the job. Requires fewer time-consuming interruptions for adjusting circuit voltages. The "YELLOW JACKET" will be on display in our exhibit at the Metal Show, with other members of the WILSON WELDER line which meets and *satisfies* every arc welding need.

WILSON WELDER & METALS COMPANY, INC.

General Office: 60 East 42nd St., New York City · Distributed through AIR REDUCTION SALES COMPANY

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ly brought to the attention of the Wellman company a complicated part now successfully constructed by welding at a saving over castings. This part was redesigned five times before it was possible to produce a welded cost lower than that of the casting. The cutting torch played an important role in the final design. The interesting point is that the welding-minded designer didn't give up until he accomplished his objective. This persistence is too seldom the case when an engineer designs for castings only.

The manager of an old established heavy equipment fabricating company was recently asked if they were designing much of their equipment for welding. He stated that they were not. Furthermore, he stated that some time ago they had welded certain equipment and the high cost of machining the parts, due mainly to warpage during welding, had convinced them there was nothing to be gained by welding. It is difficult to realize that industry can continue to exist today under such management. That man's difficulty with distortion could have been overcome in an hour by a competent welding engineer.

Nothing in late years has given welding an advantage equal to the policy of the foundry industry in establishing pound sales prices on the basis of weight, regardless of the labor involved. Thousands of items previously too costly for welding, are now so constructed. This foundry policy has made it possible to successfully re-design many details for welding, while parts costly to weld remain as castings. No doubt in time the fallacy of this method of pricing castings will be changed; in the meantime welded construction reaps the benefit, and, perhaps, due to the experience gained, will become so firmly intrenched that parts which now are in reality best suited as castings will never find their way back to the foundry. Our foundry friends, while admitting this fact, seem satisfied with their present volume and earnings, evidently resigned to the policy of letting tomorrow take care of itself.

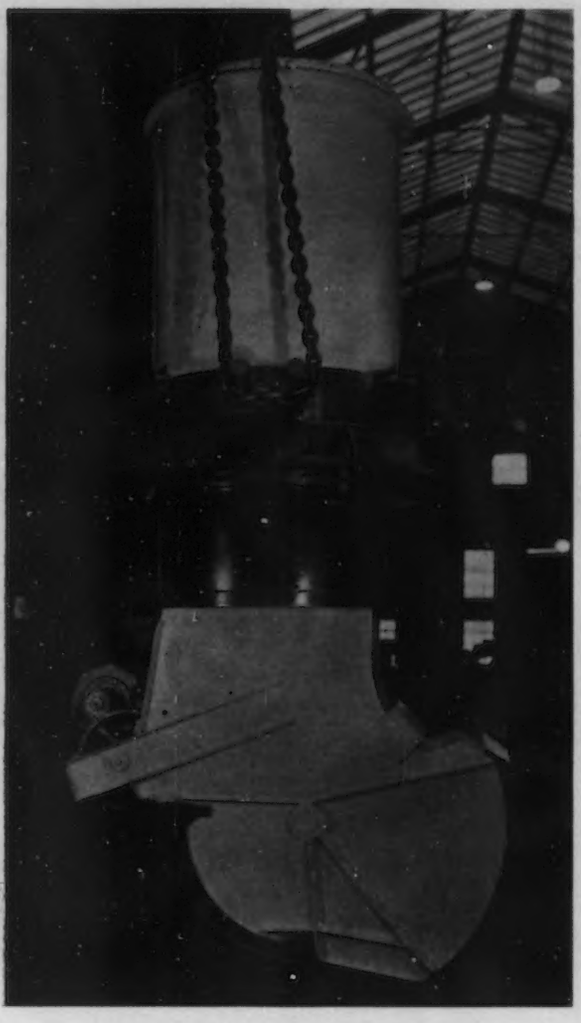

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FIG. 7—A telescopic coal chute of high-strength low-alloy steel, with plate thickness one-third less than would be required with low-carbon steel. The abrasion resisting property of this steel assures long life.

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Welding, having grown haphazardly like Topsy, has suffered to some extent during this growth. Engineers have gotten into the habit of drawing welded designs, and simply having the drawing carry the notation "weld." In the past this practice has resulted in many costly failures which have been blamed on welding, while the fault really lies at the door of the engineer. There is as much sense in a draftsman marking a part "weld" as there would be in leaving the metal thickness off a cast design, or noting on a riveted design the word "rivet" without giving the size or number of rivets required. To force the welder or foreman to guess the stress to which a part is to be subjected, and the size or type of weld to be made, is at best poor judgment. Not yet has there been found a welder or foreman, regardless of his experience in fabrication or technique, who is qualified to take the designing engineer's place in figuring stresses. Many engineers have adopted a system of designating the kind and size of weld to be made, but as yet far too many leave this to the judgment of the shop.

There recently has been adopted by the American Welding Society a revised set of welding symbols, which are simple, clear and easily learned, by which it is possible to indicate exactly the type and size of welds desired. The use of these symbols by engineers is strongly recommended in order that there may be no misunderstanding of the requirements for successful welded fabrication. It takes much more than twice as much time to lay a two-bead fillet weld than a single bead. In justice to the fabricator and the estimator of labor, it is only fair to show on the detail drawing how much welding is required. Copies of the American Welding Society's standard welding symbols may be obtained at a small cost by applying to the American Welding Society, Engineers Building, 29 West 39th Street, New York City. Their use

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cannot be recommended too strongly.

The New High-Strength Steels

Mention was made above of the use of the new low-alloy, high-strength steels in the building of welded fabrications. The term, "low alloy" covers a wide classification of steels having many qualities not found in the low-carbon steels commonly used in welded construction. These steels are, in the main, simply low-carbon steel to which have been added certain alloys in varying amounts in order to produce desired physical and metallurgical properties. First, they are high-strength steels, many of them having yield strengths of 60,000 lb. per sq. in., and ultimate strengths of 90,000 or more lb. per sq. in. In addition to the high tensile strength, many of the low-alloy steels possess properties of resistance to corrosion or resistance to abrasion, these properties being very desirable under many service conditions.

The light-weight, high-speed passenger train, the diesel engine, material handling equipment, clam shell and drag line buckets and moving mechanisms of many types are fields in which the low-alloy steels have found wide use. Because of the advantage of their higher strength, large savings in weight are possible. Engineers conscious of this advantage have given thought to further savings effected by modern and efficient design. The cost of low-alloy steel is approximately twice that of low-carbon steel, and the effort to keep the finished cost down has led to constructive results in using the metal to its best advantage to withstand tension, bending, fatigue and impact.

While these new alloy materials are safe for welding in competent hands, those of the higher strength range possess considerable air hardening properties, necessitating due precaution in welding and gas cutting. Where practical, they should be heat treated to remove brittleness after welding. When this is not practical, because of size and possible distortion, the carbon content should be limited even at the sacrifice of some strength. The producers of low-alloy steels are ready to cooperate with the user, and it is advisable to consult them regarding welding and cutting technique. There is no excuse these days for deliberately stepping into the trouble experienced by the fabricator who recently consulted the writer regarding the cracking of abrasion resistant steel after welding. He stated that the steel producer was asked for the best abrasion resistant steel obtainable without explaining the method of fabrication. He was supplied with an 0.80 per cent carbon low-alloy steel, and was greatly surprised to find the welding strains set up were sufficient to rupture the plate.

Under severe abrasive conditions it is often advisable to weld abrasive material to the part subject to wear. Engineers of the Wellman company recently inspected a material handling mechanism which had moved millions of tons of clay in the construction of levees along the Mississippi River. Those parts ordinarily subject to abnormal wear showed no perceptible wear in a period of 12 months, even though the abrasive material deposited was not over 3/16 in. thick by ⅝ in. wide.

Many of the low-alloy steels have fine qualities of resistance to corrosion. The corrosion resistant property of these steels is a result of the copper or copper-phosphorus content. For many years there has been obtainable low-carbon steels with a copper content of 1/3 to ½ per cent, which have proved efficient, particularly in salt atmosphere encountered at sea ports. The new corrosion resisting low-alloy steels are not only greatly superior in corrosion resistance, but also possess considerably high-

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FIG. 8—Welding fixtures such as these are indispensable aids in low-cost welding and interchangeability of parts. While the initial investment is considerable, it is quickly saved in lowered man-hours and eliminates the possibility of errors in alinement.

o o o

er physical properties than low-carbon steels. Some analyses with 0.20 per cent carbon content have yield points of over 60,000 lb. per sq. in., and an ultimate strength of 90,000 lb. per sq. in.; those with 0.10 per cent carbon have yield strengths over 50,000 lb. per sq. in., and an ultimate strength over 75,000 lb. per. sq. in.

Even under such service as contact with saturated brine, some of these steels have proved to be four to six times as corrosion resistant as low-carbon steel. These results justify the use of such material, even at prices several times the cost of low-carbon steel. Due to their high physical strength, a considerable percentage of the increased cost of low-alloyed steel over low-carbon steel can be offset by the reduced weight of metal required.

Fig. 5 is an example of the use of low-alloy steel to obtain increased strength at low weight. The clean-up bucket shown has a spread of 24 ft., and the scoops are 9 ft. 2 in. wide. The sheave blocks, Fig. 6, are of welded design, heat treated for stress relief, while the frame work has been riveted because of the impracticability of heat treatment. Equipment of this type, in low-alloy steel, is sold with a guarantee against breakage. Dozens of large and heavy duty buckets carrying this guarantee have proved their ability to stand up under the most severe stresses.

Abrasion Resistance

Low-alloy steels of relatively high manganese content have excellent abrasion resisting properties. These steels are widely used in equipment for handling ore, coal, stone and sand. Fig. 7 shows a telescopic chute and gate for loading coal in boats. In this instance, low weight was of prime importance. The use of abrasion resisting steel made possible a reduction in plate from ⅜ in. to ¼ in., a saving of 33 per cent in weight. For welding, it is advisable to limit the carbon content to 0.25 per cent to 0.30 per cent, as a higher carbon content together with high manganese produce excessive air-hardening in welding and gas cutting operations. When the higher air-hardening steels are used, it is advisable to preheat before welding to prevent the welds cracking in cooling.

(CONTINUED ON PAGE 148)

Maintenance
WELDING AND CUTTING EQUIPMENT

WELDIT MODEL-'S' Cutting TORCH

For general cutting. Furnished with Monel heads and tubes. Optional heads 70°, 90° or straight. Length 21". Weight 2 lbs. 12 oz. Thousands in service.

WELDIT MODEL P-30 Welding TORCH

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WELDIT MODEL "W" Automatic WELDING TORCH

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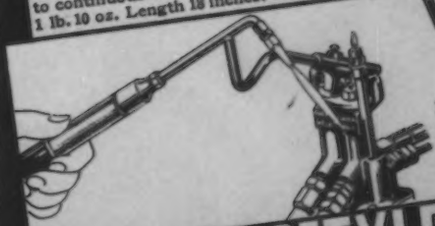
WELDIT MODEL "A-20" Automatic WELDING TORCH

Has automatic shut-off (gas saving) feature for intermittent welding work or instantly adaptable to continuous welding job by simply sliding thumb lever into retaining or locking slot. Weight 1 lb. 10 oz. Length 18 inches. Tip sizes 2 thru 12.



WELDIT MODEL "E" GASAVER

Hanging torch on Gasaver hook, between welds, automatically shuts off intake lines, saves gas. Lifting torch off hook and passing across pilot light instantly produces full welding flame, no re-adjusting necessary.

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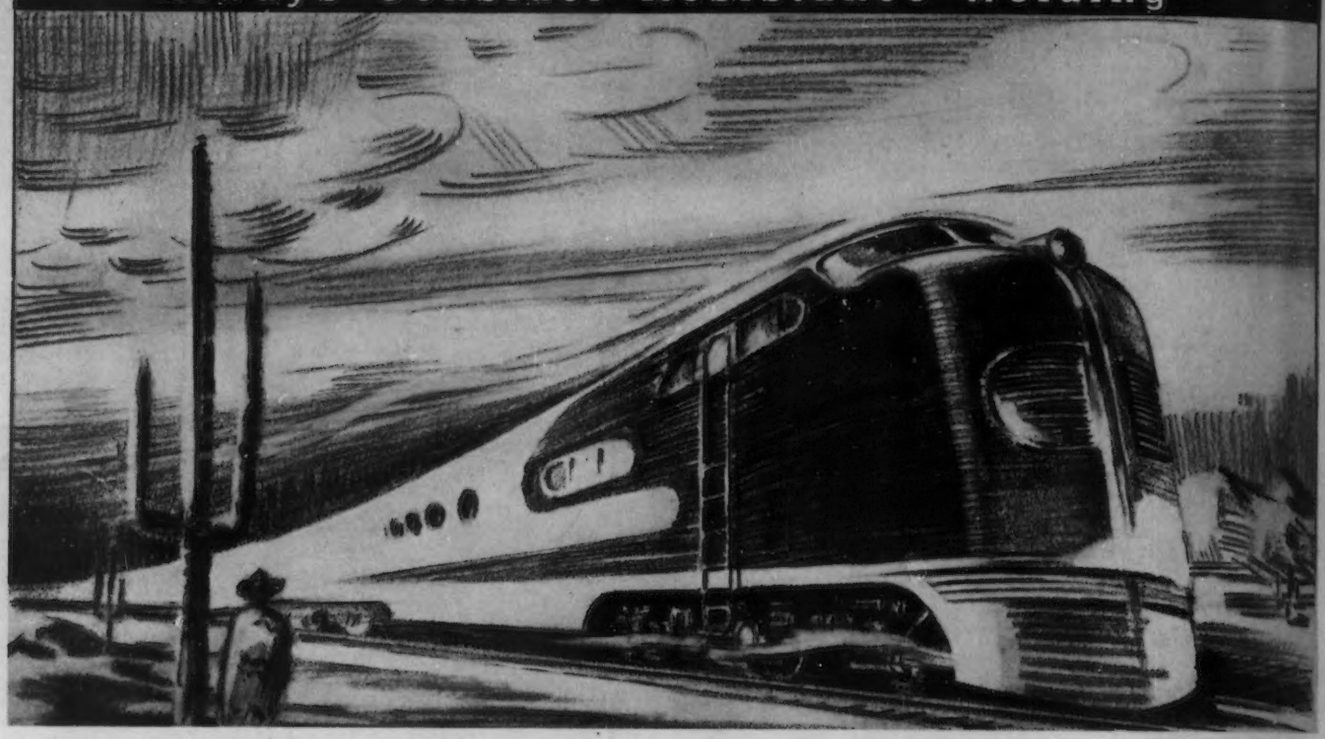

RESISTANCE WELDING PUTS *Speed* INTO PRODUCTION

No method of fabrication is receiving more attention today than resistance welding. Recent developments in both standard and specially built machines have accomplished such remarkable results in *speeding up production* that manufacturers in many industries are forced to adopt this process in order to keep abreast of the times. For every type of metal fabrication where quantity production is a factor "always consider resistance welding." Its uses for cutting costs are expanding by leaps and bounds.

Resistance welding gives strength and rigidity to solid, flush, smooth joints that can be enameled, Ducoed or japanned—and does the work economically. Many jobs that formerly required ten or twelve minutes by other processes are now completed in a few seconds.

Federal is the nation's leading manufacturer of standard and special resistance welding equipment. A complete engineering service is at your command.

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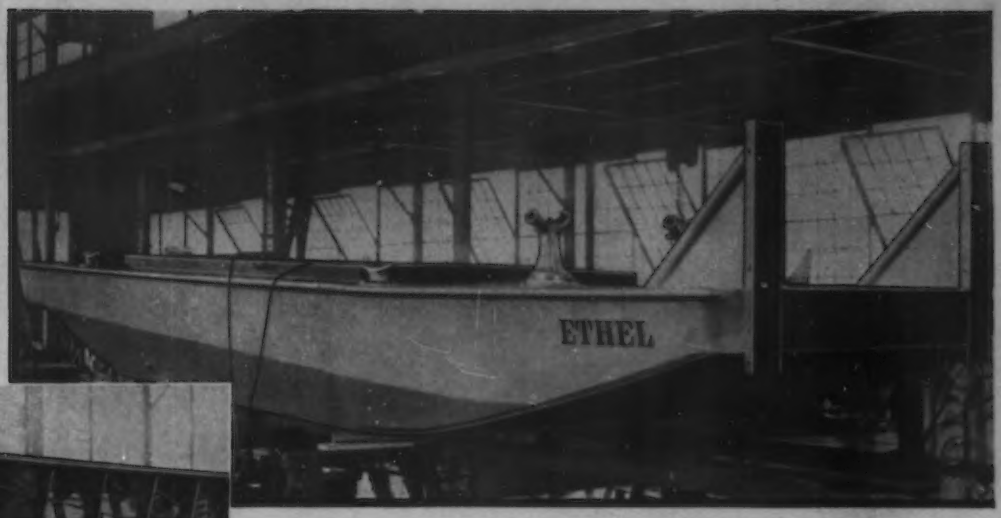

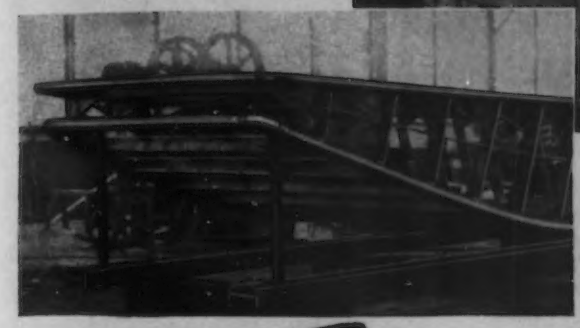

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NO OTHER MACHINE HAS THIS PATENTED INTERNAL STABILIZER

Through this ingenious design, the Smootharc Generator uses the arc impulses to speed up flux changes —combines "governor action" and "flywheel effect"— cuts down current variations to produce a steadier arc. Comparative oscillograph records show the unusually narrow limits within which peak current fluctuations are held. More even welding heat makes it possible for the Smootharc Welders to produce sound, uniform welds at the highest rate of speed. Why not demonstrate this fact to your own satisfaction? For complete information, address the Harnischfeger Corporation 4401W. National Avenue Milwaukee, Wis.

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The complete line of Smootharc Welding Electrodes includes sizes and types for all classes of work. The formula and physical character of each one have been determined by practical shop tests, verified by exacting analyses in the chemical and physical laboratories. Smootharc Electrodes are produced in the country's newest and most modern welding-rod plant.

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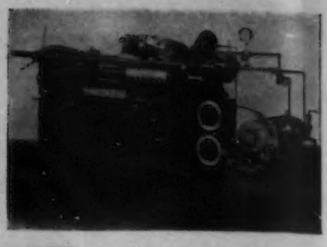

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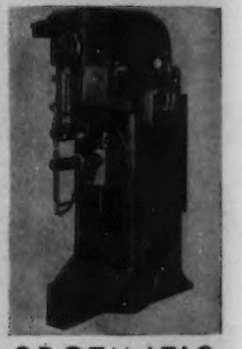

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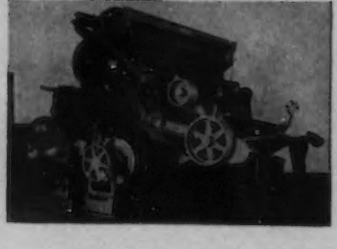

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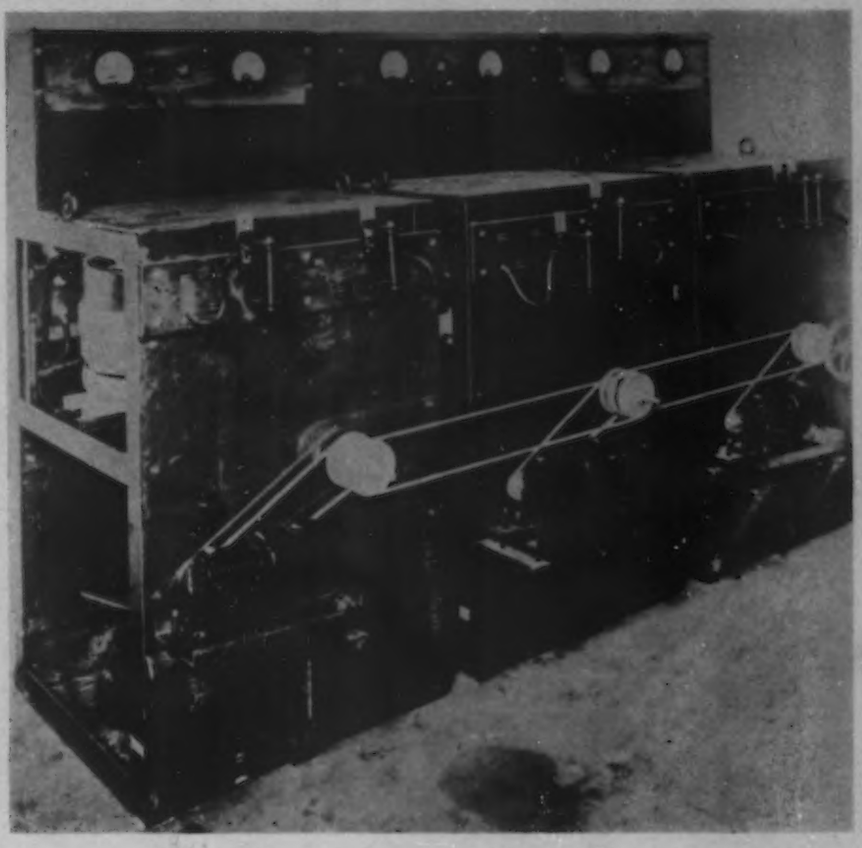
Alternating Current Scores Again

WHILE it has become generally known that combination of alternating current and shielded arc electrodes is a "natural" for best results, now the combination of alternating current with the new submerged arc or, as exemplified by the Unionmelt system, is also best for heavy and automatic work. This use of bare wire submerged in flux and slag accomplishes fillet and lap welding as well as butt, and for manual welding of narrow places where this deposit must have no under-cutting and where it is extremely desirable to have the deposit creep up the sides of the parent metal leaving the weld surface concave, there has been developed the



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an electrode so covered that the arc melts the electrode always inside the covering.

A medium coated electrode suitable for work where a high speed and a clean finish are necessary.

The electrode is so constructed that it burns with a cup formation and if the tip of the electrode touches the metal it will not stick. The ability to maintain a contact arc gives not only a neater weld but effects a saving in electrodes as wasteful splutter is eliminated. This method of welding enables the arc to be automatically maintained at a much shorter length than is possible in free hand welding; further, it is extremely simple and for corner welding or for lap or fillet welds has great advantages due to being able to fill the reentrant vee according to drawings and designed section. The best results are obtained by having the current set 10 to 15% above normal. The arc should be struck in the ordinary way and after holding for a second the electrode tip may be brought down into the corner and kept down with a slight pressure. The electrode may then either be drawn along in straight line at an angle of 40 to the job or allowed to travel its own speed.

This protects the deposited molten metal so that it is never contaminated by the air impurities. Metallurgists are undecided as to whether the oxygen or nitrogen of the air, or what not, spoils the deposited metal, but all authorities agree that if the air is kept away the weld deposit is best. Even with the shielded arc the air gets in some deadly, bad work, but with the "Contact Arc," the metal never never sees the air, all melting taking place inside a cylinder of covering which is in contact with the work and serves to space the arc in difficult positions, as in overhead, vertical, corner or hole welding. Overhead and vertical can be done blindfolded.

No under cutting with this electrode.

The "Contact Arc" electrode is obtainable at no increase in price, and is available in even diameter or Compensating (tapered) rods.

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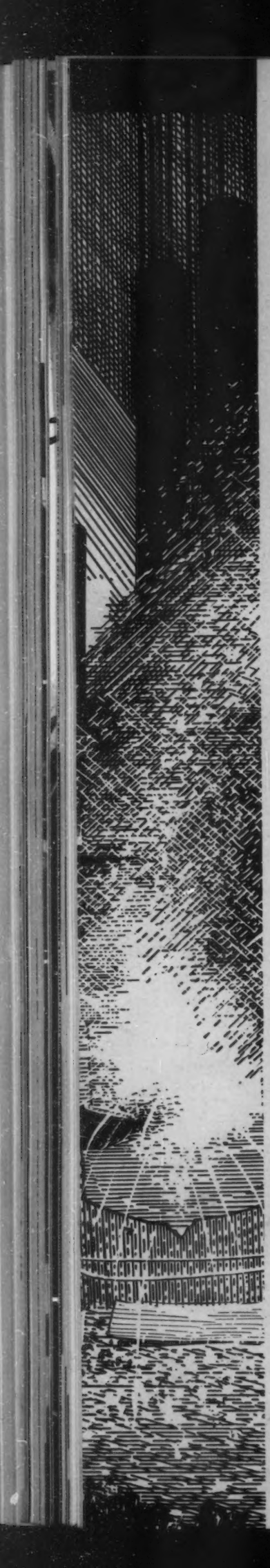
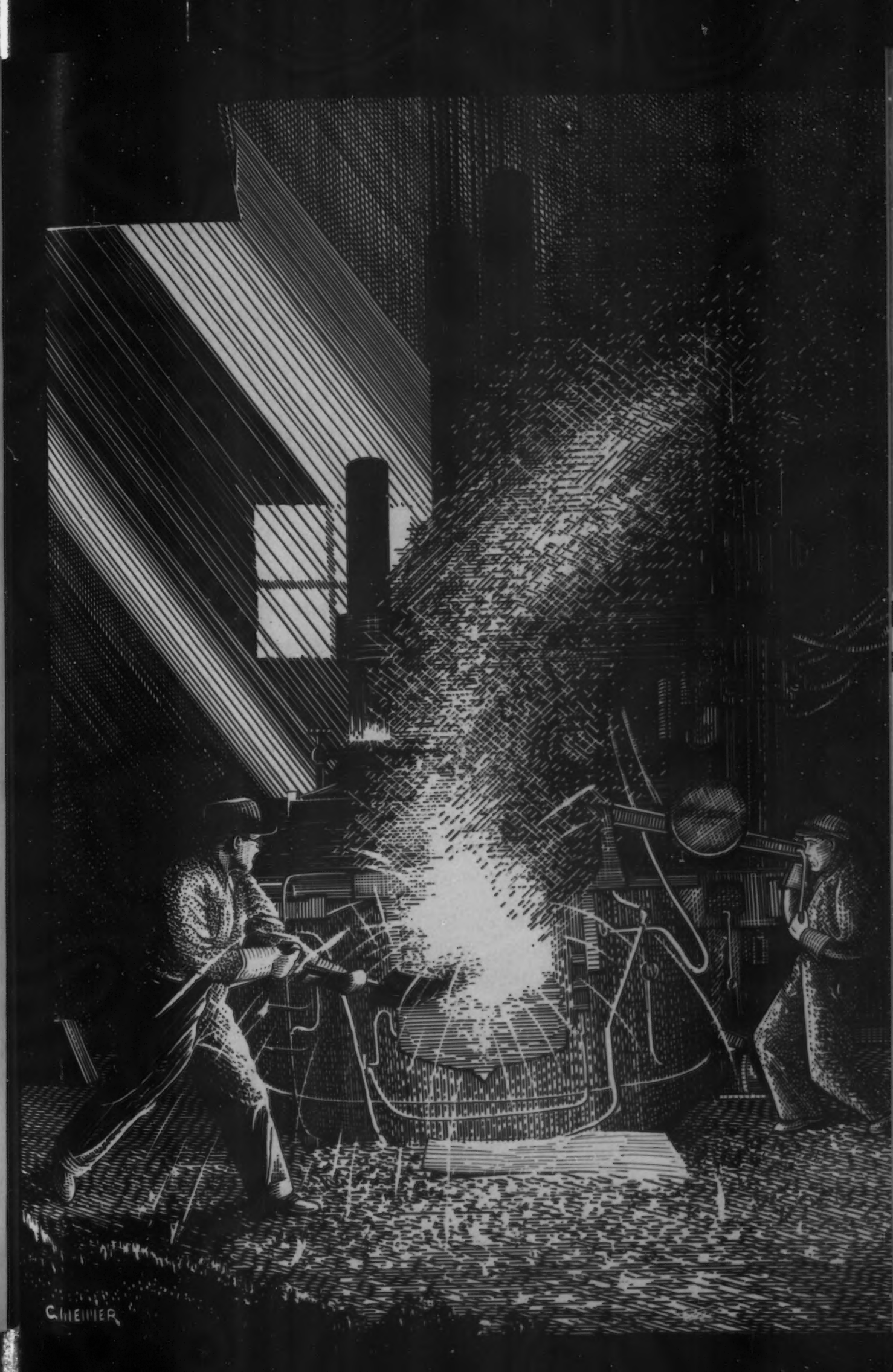


METALS

FOUR hundred years ago, Queen Elizabeth's favorite, Dud Dudley, cursed the "bloomenies" for their inability to make more than, . . . "one little lump or bloom of Iron a day, not 100 weight, and that not fusible nor fined, or malliable, untill it were long burned and wrought under Hammers, and whose first slag, sinder or scorius, doth contain in it as much, or more Iron, then in that day the workman got ont." So was England's ore directly reduced for 300 years, after which the great Bessemer invented . . . "a new metal, and a wonderful metal it is, by an entirely different process." Bessemer's contemporary, Siemens, with his regenerative open hearth subsequently, . . . "produced steel at a moderate cost, and with all the excellent qualities of Bessemer metal. Ten-ton furnaces are being built and will produce 20 tons of steel in 24 hr."

Siemen's open hearth reached its ultimate perfection in the United States, but it supplanted rather than supplemented the converter, and, today, 250-ton units can turn out almost 500 to 700 tons of refined steel in 24 hr.

But this day there is a French inventor, R. Perrin, who urges the return of the converter and the abolishment of slow refining in Siemen's furnace. He says to melt a suitable slag in a separate furnace, and pour unrefined steel into it, and, presto, a fully refined heat of high-grade steel is available. What Mr. Perrin has done and is doing is best described by himself. He does so in the following article.


C. HEINER

Unhampered by quality troubles

because the ingot practice is righ

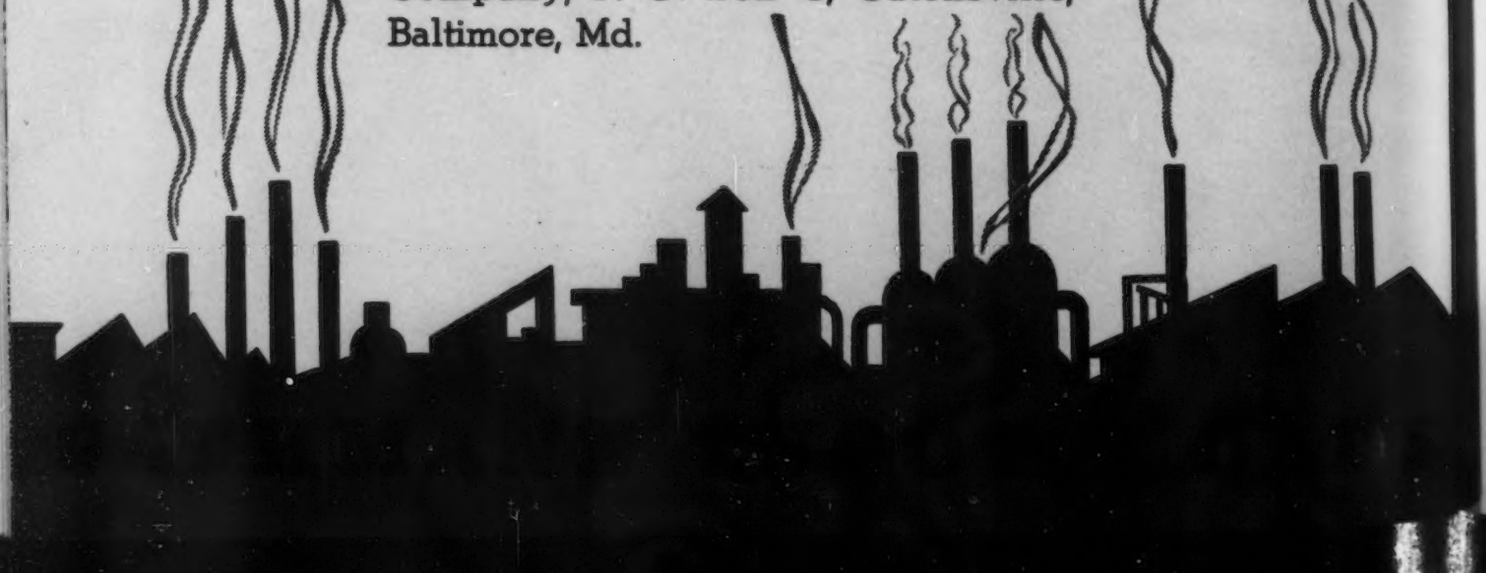
RUNNING a steel plant without quality troubles is exacting work, but it can be done.

Essentially, it consists in producing sound ingots, because unless an ingot is physically sound, inside and outside, there is no assurance whatever that it will stand up during fabrication.

With the authority born of his wide experience in devising methods and designing molds for sound ingot production, Mr. Gathmann has written a new book, *The Ingot Phase of Steel Production*, outlining how quality troubles may be avoided in all types of steels.

Whether you produce steels or buy them, you can't afford to miss reading this comprehensive work on so vital a subject.

Write for a library edition on your company letterhead. It will be sent to you promptly. The Gathmann Engineering Company, P. O. Box 8, Catonsville, Baltimore, Md.



PERRIN'S RAPID STEEL REFINING

By R. PERRIN

Société d'Electro-Chimie, Paris, France

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THE general principles of the Ugine-Perrin processes having been dealt with on previous occasions, it is not necessary here to do more than recall that the technique results in extremely rapid reactions between molten slags and metals, which arise from the considerable extension of the surface of contact.

These processes spring from the idea that at high temperatures the reaction speeds proper are extremely great and that the time involved to accomplish such reaction is essentially a function of the contact surface. I should like to emphasize the fact that such a duration is not in practice governed by the magnitude of the reaction involved, but that the difference between the initial composition of reagents and the final analysis sought is only a secondary factor in the duration of the processes, provided the proper surface of contact is insured.

I think the following example will be a satisfactory explanation: A metallic alloy, with a content of 50 per cent. silicon, has been reduced to 0.5 per cent. silicon in about one minute's time — the Ugine-Perrin processes, by doing away altogether with the slowness of diffusion, have allowed the realization of most complete reactions at speeds never approached up to now, such results being attained through an automatic cycle, comparable to a chemical reaction cycle, entirely independent of human factors and the greater or lesser skill of various operators.

Similar principles have been extended to reactions involving other materials than molten slags.

The brief foregoing outline indicates that the field of application of the Ugine-Perrin processes goes beyond the steel metallurgy field proper—in fact, industrial exploitations even now exist in these other fields. However, the following article will deal only wtih steel metallurgy, i.e., exclusively with regard to dephosphorization and deoxidization of steel.

For a better understanding of

the basic philosophy of the Ugine-Perrin processes, it should be of interest to set down a short account of how they came into existence.

The Aciéries Electriques d'Ugine are located in the French Alps, far from the Parisian region, which is both the center of scrap production and the consumption of finished alloy steels. In France, by far the cheapest molten steel available is basic bessemer steel produced in Northern and Eastern France, the regions of coal and iron deposits. This is why, for quite a long time, a number of companies have tried the duplex practice (basic converter and electric furnace) for economical reasons, and plants today are operating with such a practice.

The Société d'Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine, owner of the Ugine Steel Works, has desired to duplicate this practice for the same economical reasons. For this purpose, the Sociétié Aciéries Ugine-Uckange, was founded in association with the Société des Aciéries du Nord et Lorraine, which owns blast furnaces at Uckange (Moselle). This new company was to build basic bessemer converters and electric furnaces.

Steel produced by the basic bessemer converter, with a phosphorus content around 0.04, was to be further treated in order to attain a further dephosphorization in the basic electric furnace with the formation of a basic slag rich in iron oxide, followed by a slagging off. Then the conventional deoxidization process was to take place under a carbide slag. The succession of such different operations led to several hours stay in the electric furnace, thus entailing the necessity of equipping several electric furnaces to take care of the metal produced by one single basic bessemer converter. Furthermore, the relatively high cost of electric current in the Moselle area was a real hindrance.

Consequently, I had in mind to find out the best means to shorten the electric furnace cycle, and it obviously came to my mind that the most natural means to avoid the dephosphorization process in the electric furnace was to charge in it steel that had already been dephosphorized. And that is how I have been led to imagine and carry out commercial dephosphorization in the ladle by means of liquid slags. The idea of melting slags in separate furnaces occasioned little concern in my company, as we were already involved in the manufacture of molten cement, alumina, magnesia, etc.

The first very important result was thus attained for the Uckange operations—later on, after further thought on the subject, I conceived the possibility of deoxidizing steel by a similar process. The dissolution of oxygen in steel being a consequence of dephosphorization, it appeared to me that if it were possible to have oxygen dissolved by slag action, the reverse phenomenon —elimination of oxygen by slag— should be possible to control. The problem was to conceive and dispose of proper molten slags, fluid enough to permit an emulsification, and this is how we came to the conception of fluid acid slags low in iron oxide.

Building Plans Changed

The consequence of this appeared obvious to us—the possibility of entirely suppressing the electric furnace for dephosphorization and deoxidization of acid bessemer steel. The immediate result was that we gave up the building of the Ugine-Uckange plant and decided to carry out our effort on the reorganization of an existing basic bessemer plant. In fact, if we had been led to imagine the construction of a plant with new basic bessemer converters to supply electric furnace with molten steel, the reason was that no room could be found in the existing Thomas plant to equip electric furnaces. Those new ideas entirely changed the problem, and we thought it was useless to spend the money already appropriated

Physical Properties of Ten Nickel-Chrome Steels Made By the Ugine-Perrin Processes

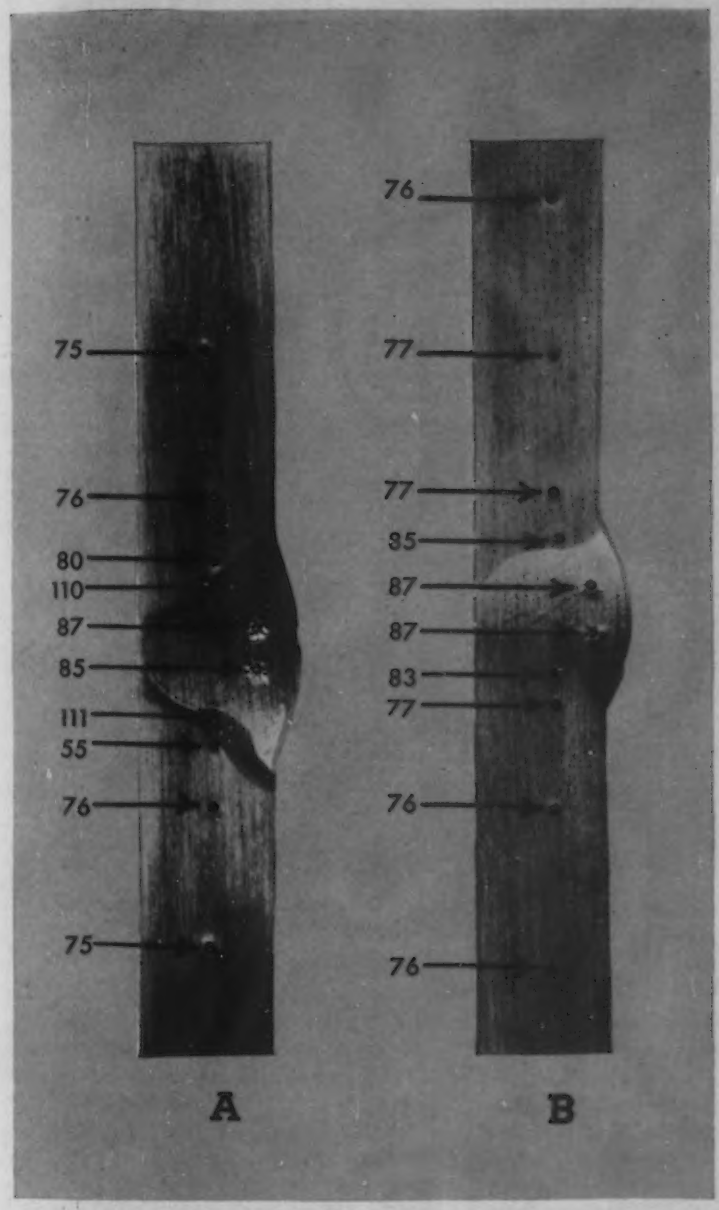
Heat No.	Chemical Analysis					Physical Properties Oil Quenched at 1517 Deg. F., and Annealed at 482 Deg. F.						Physical Properties Oil Quenched at 1517 Deg. F., and Annealed at 1112 Deg. F.						Oil Quenched 1517 Deg. F.
	C	Ni	Cr	S	P	R	E	A	Σ	P_L	P_T	R	E	A	Σ	P_L	P_T	Δ
98.555	0.36	2.75	0.77	0.017	0.014	182	170	6.5	39	5.1	...	102	93	13.0	58	11.4	...	514
98.559	0.35	2.73	0.83	0.020	0.021	172	162	7.0	40	4.9	...	97	89	12.0	58	12.0	...	514
98.566	0.34	2.75	0.79	0.015	0.010	177	166	7.0	35	5.9	...	99	90	12.0	62	13.1	...	477
98.576	0.36	2.65	0.86	0.019	0.012	182	170	7.0	37	4.9	...	101	93	12.0	59	11.8	...	495
98.587	0.30	2.60	0.70	0.010	0.010	171	160	7.0	42	5.6	2.6	95	89	12.0	61	15.7	6.2	477
98.598	0.33	2.70	0.85	0.022	0.013	177	161	8.0	43	5.1	3.2	101	92	12.5	59	18.4	5.6	514
98.604	0.36	2.80	0.84	0.011	0.011	183	171	7.0	37	4.6	3.0	103	93	12.0	58	12.1	5.6	514
98.646	0.35	2.60	0.90	0.015	0.010	181	160	7.0	38	5.6	3.2	100	93	11.5	63	13.8	5.4	514
98.692	0.33	2.85	0.78	0.012	0.010	174	159	7.0	35	5.6	...	100	93	12.0	57	11.8	...	514
98.706	0.36	2.80	0.88	0.015	0.010	179	167	7.0	43	4.4	...	106	99	12.0	60	11.1	...	514

R = tensile strength; E = yield point; A = elongation in per cent; Σ = reduction of area; P_L = impact value on lengthwise test piece; P_T = impact value on transverse test piece; and Δ = Brinell hardness.

On four of the selected ten heats, transverse impact tests were made and the results are as indicated in the chart: In the one case the test piece was quenched in oil at 1517 deg. F. and annealed at 482 deg. F., and in the other case the test piece was quenched in oil at 1517 deg. F. and annealed at 1112 deg. F.

The last column shows the Brinell hardnesses for test pieces quenched in oil at 1517 deg. F. with no subsequent annealing.

Columbium prevents air-hardening in 4-6 per cent chromium steels



TESTS indicate that about 0.5 per cent columbium in 4-6 per cent chromium steels effectively prevents air-hardening. This makes possible the use of these steels in the as-rolled and as-welded state without subsequent annealing.

Columbium is easily added to 4-6 per cent chromium steels as ferrocolumbium. Electromet can supply you with ferrocolumbium and assist you in its advantageous use. Ask an Electromet metallurgist to call and help you obtain the benefits of columbium in your 4-6 per cent chromium steels . . . Or write for further information today. This will not obligate you.

Rockwell "B" hardness values are indicated at various points in these etched cross sections of welds in 4-6 per cent chromium steels. Specimen A contains 5.09 per cent chromium, 0.46 per cent molybdenum and 0.07 per cent carbon. Specimen B contains 5.82 per cent chromium, 0.53 per cent molybdenum, 0.06 per cent carbon and 0.51 per cent columbium. Note that the columbium-bearing steel shows practically no air-hardening in the zone adjacent to the weld.

See the Electromet Exhibit featuring the value of Columbium for inhibiting intergranular corrosion at the National Metal Show, Atlantic City Auditorium, Atlantic City, N. J., October 18-22, 1937, Booth G62.

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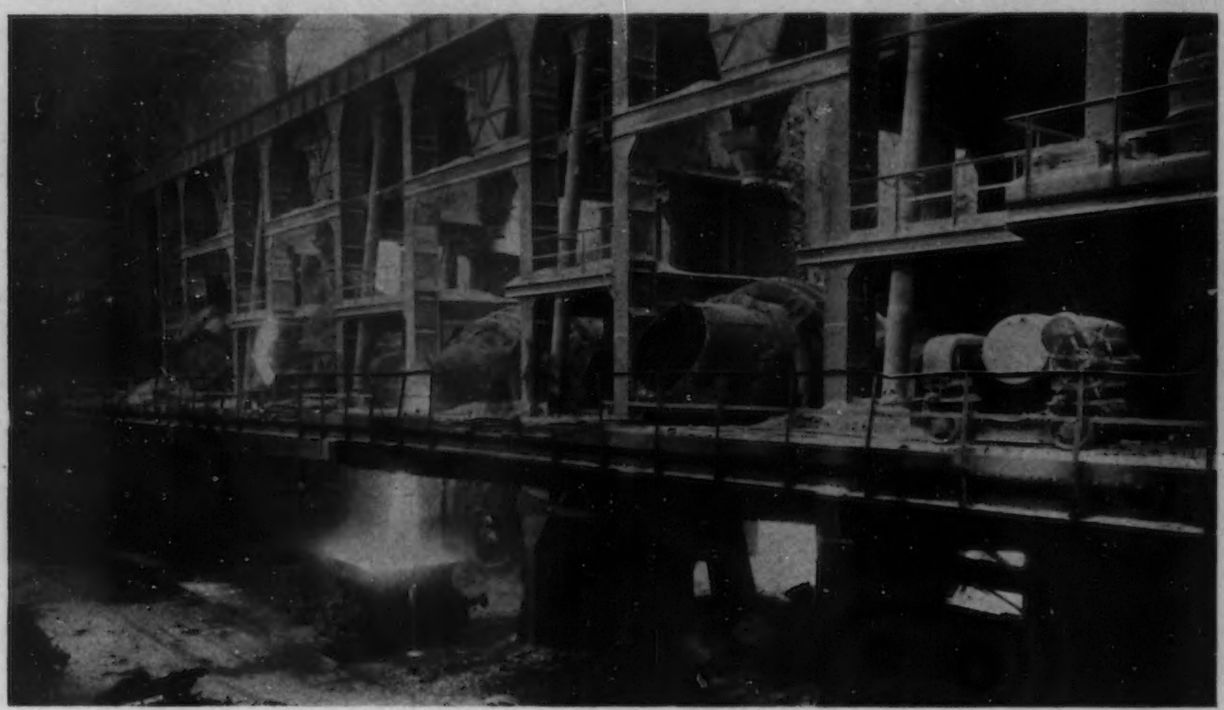
for the building of the new basic bessemer plant.

I believe it is worth while to show that from the beginning the Ugine-Perrin processes were intended for the manufacturing of high grade steels from the cheapest possible available molten steels (bessemer)—even though it were superoxidized—and I have always worked in that direction. In my opinion, it is in this spirit that our process must be considered.



BASIC bessemer steel plant at Valenciennes, France. Although the United States has no basic converters, it is of interest to note that this plant has established a record in the production of clean steels of high physical properties, by means of the Ugine-Perrin processes.

I will try hereafter to show with practical examples the possibilities of the processes, and, personally, I am convinced that cheap raw material, speed and automaticity, are the prime requisites of the future. We have worked hard in this direction, ignoring all other mediums of research we could have followed, since we could not explore all the fields at the same time.

The results already attained are a confirmation of our beliefs, and we sincerely think that our work has contributed to a certain extent to the way to be followed in the future.

Dephosphorization

Three practical problems of dephosphorization are to be faced, namely, basic bessemer steel, acid bessemer steel, and pig iron.

In basic bessemer steel the basic lining of the converter allows the complete dephosphorization of the steel in the converter itself, which is a positive advantage if the steel is to be further deoxidized by pouring it onto an acid slag in the ladle. Thus, losses of heat by transferring from one vessel into another are avoided.

The operation consists of first overblowing, then slagging off of the converter as perfect as possible, followed by the addition of molten basic oxidized slag into the converter, and, finally, a further blowing of a few seconds. Such a process allows the obtaining of any desirable state of dephosphorization as well as desulphurization, and also the production of a very hot metal, the latter of which is a very important item. I mention this process merely for the record, since the basic bessemer operations is not an American practice.

The acid bessemer converter, being an American problem deserves somewhat more lengthy comments. We had to study this problem on behalf of an important foreign steel works that manufactures steel by duplex (acid bessemer and open-hearth) practice. It was necessary to examine the production of steel starting from acid bessemer steel containing about 0.3 phosphorus and to study whether it was possible, by means of one single operation in the ladle, to bring down the phosphorus to a content between 0.05 and 0.09, according to the required grades of steels.

Preliminary experiments have been carried out at our Ugine plant in the presence of the representatives of that foreign steel works. The slag was melted in an electric furnace, and it contained about 5 per cent silica, 35 per cent iron oxide, the balance being lime and fluorspar. Fifteen tons of steel was treated during the operation, and the time spent in pouring those 15 tons on the slag was about 45 sec. It was most encouraging to have the first experiment give the desired result. The experiments were duplicated abroad on bessemer steel but with the help of an intermediary ladle, since the equipment of the plant did not allow an easy handling. The slag was melted in an open-hearth furnace. The final results were identical with those obtained in our plant.

Consequently, it seems obvious that the dephosphorization of

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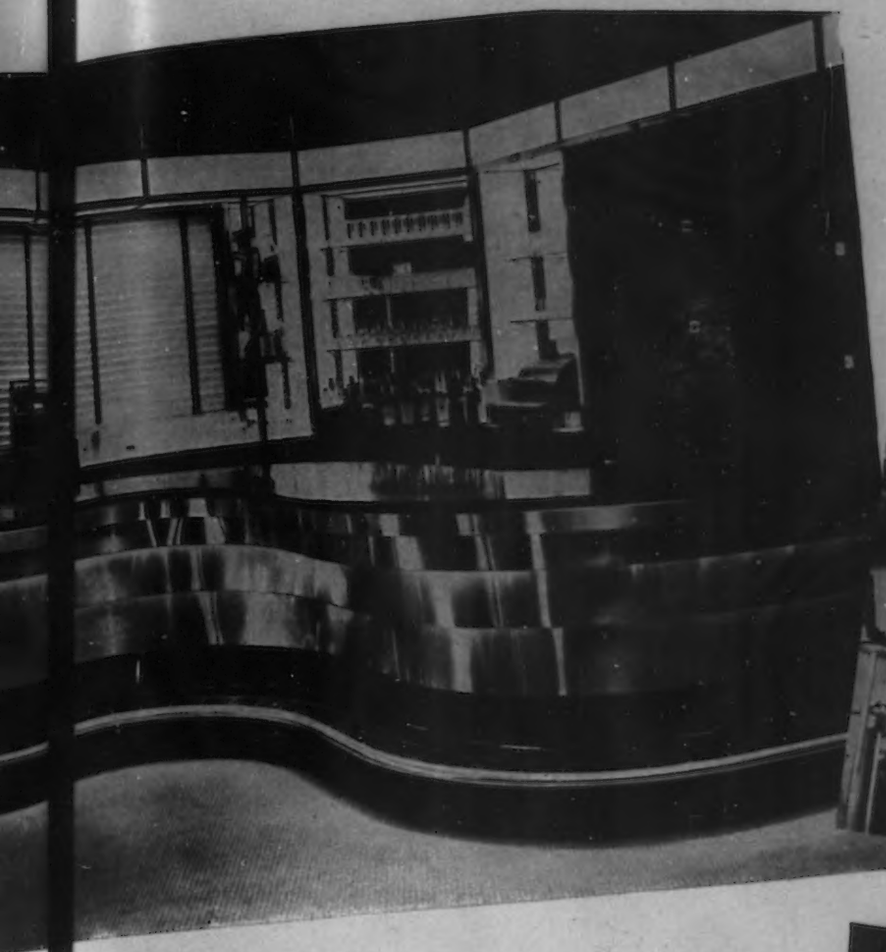

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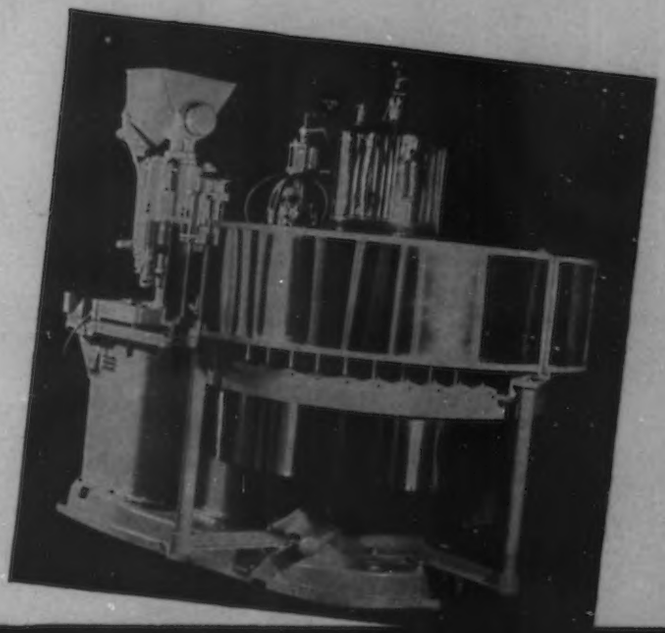
Above: This streamlined bar was made from Armco 18-8 Stainless of high-luster polish. Note the evidence of fine finish and beautiful design.

Left: Many parts in milk-bottling machines can better be made of Armco Stainless for sanitation, ease of cleaning and attractive appearance.

Right: In the soft-drink industry Armco Stainless Steel is deservedly popular as this large bottling and crowning machine clearly indicates.



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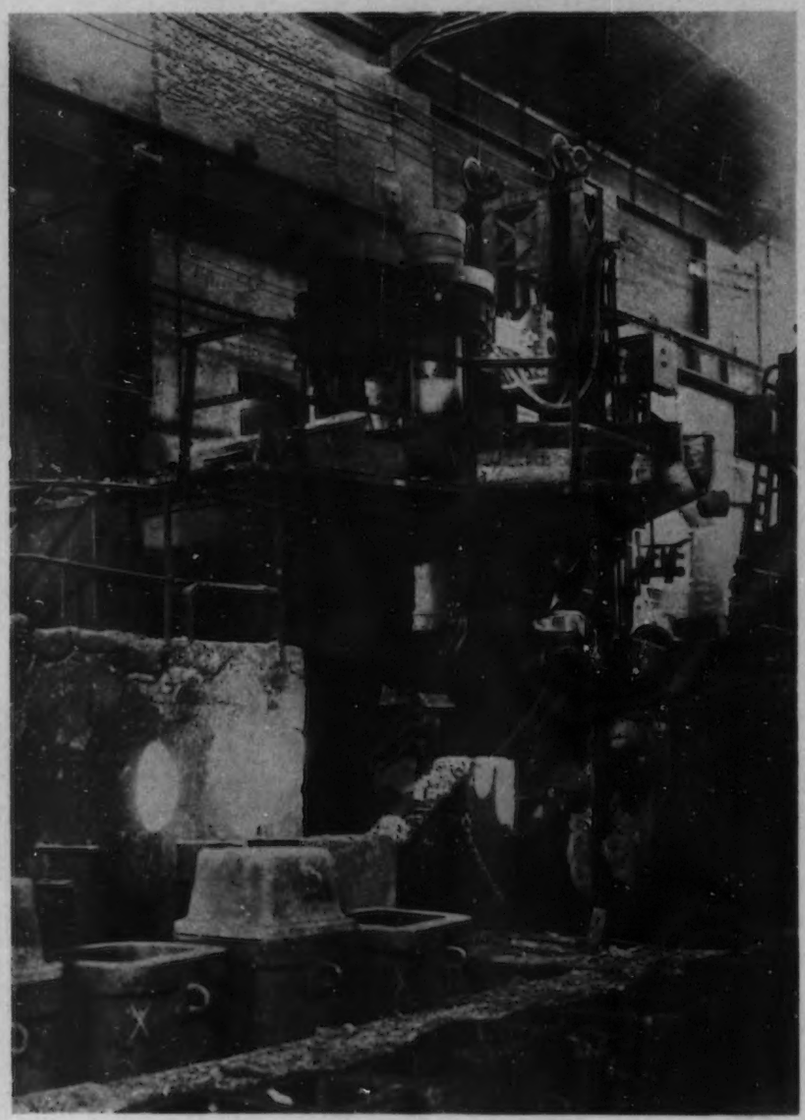
American acid bessemer steel with 0.10 phosphorus, is undoubtedly possible by our processes, by means of one single ladle operation. The only possible difficulty is a proper elimination of the acid slag from the converter, by mechanical or by other means, so that it does not mix with the basic slag. If small quantities of acid slag were to be poured with the steel, the only inconvenience resulting from it would be the corresponding increase of the amount of oxidized basic slag required to obtain the required dephosphorization effect. The slag can easily be melted in a flame furnace, either coal, oil or gas fired.

The problem of merely dephosphorizing bessemer steel without seeking a complete deoxidization for ordinary grades of steels, and the subsequent teeming of steel into ingot molds immediately after dephosphorization, should be of some interest. However, it would be necessary in that case to make the required manganese addition. It would be possible first to dephosphorize the steel by first pouring it into a ladle, then to pour it into a second ladle containing ferro-manganese, and then to teem from that second ladle into ingot molds. But this practice would compel a rather complicated handling and lead eventually to a cooling of the metal.



A VIEW of the electric furnace at Ugine melting the acid slag used for the rapid refining of steel. Using this procedure, the total time required for an entire steel-making operation, from cold scrap to finished steel, is about the same as that required for deoxidization alone in conventional practice.

I had to study this very problem for the same foreign steel works that was considering the manufacture of tin plate steel with about 0.08 phosphorus. I had in mind that it was possible to dephosphorize steel already containing manganese and to retain the manganese during the mixing operation with the slag by using a slag containing a sufficient quantity of manganese oxide. It is known that there exists a relation of the equilibrium between the content of MnO and FeO in the slag and the content of Mn in the metal, as follows:

$$\frac{MnO}{(FeO)\ (Fe)} = KMn$$

The value of the constant KMn is a function of the temperature as well as of the slag composition—mainly of its acidity. Regarding highly basic slags and usual temperatures in steel works, the value of KMn is around 200.

If a final content of Mn—called a—is desirable in steel, the composition of the slag must be reckoned so that after mixing and the oxidization of phosphorus by the iron oxide, the ratio $\frac{MnO}{FeO}$ should be equal to (200) (a). The following example gives the results of an experiment carried out at Ugine. The initial starting steel had a composition of 0.270 phosphorus and 0.26 manganese. The slag used had the following composition:

SiO_2	Iron oxide	MnO	CaO
5	26	10	49

After mixing with slag the steel contained 0.08 phosphorus and 0.25 manganese. And the slag contained:

SiO_2	Iron oxide	MnO	CaO
8	20	10	45

The steel was teemed directly into ingots with a mold addition of a silico-aluminum alloy containing about 65 per cent aluminum and 33 per cent silicon (a very fusible silicon alloy). The ingots looked quite satisfactory for the contemplated use.

American Practice Possible

I think I am entitled to state that it is possible to dephosphorize American bessemer steel, by adding ferromanganese to the converter and getting the desired manganese content in the final steel. Like all the commercial realizations that we have carried out up to date, the commercial realization of such a

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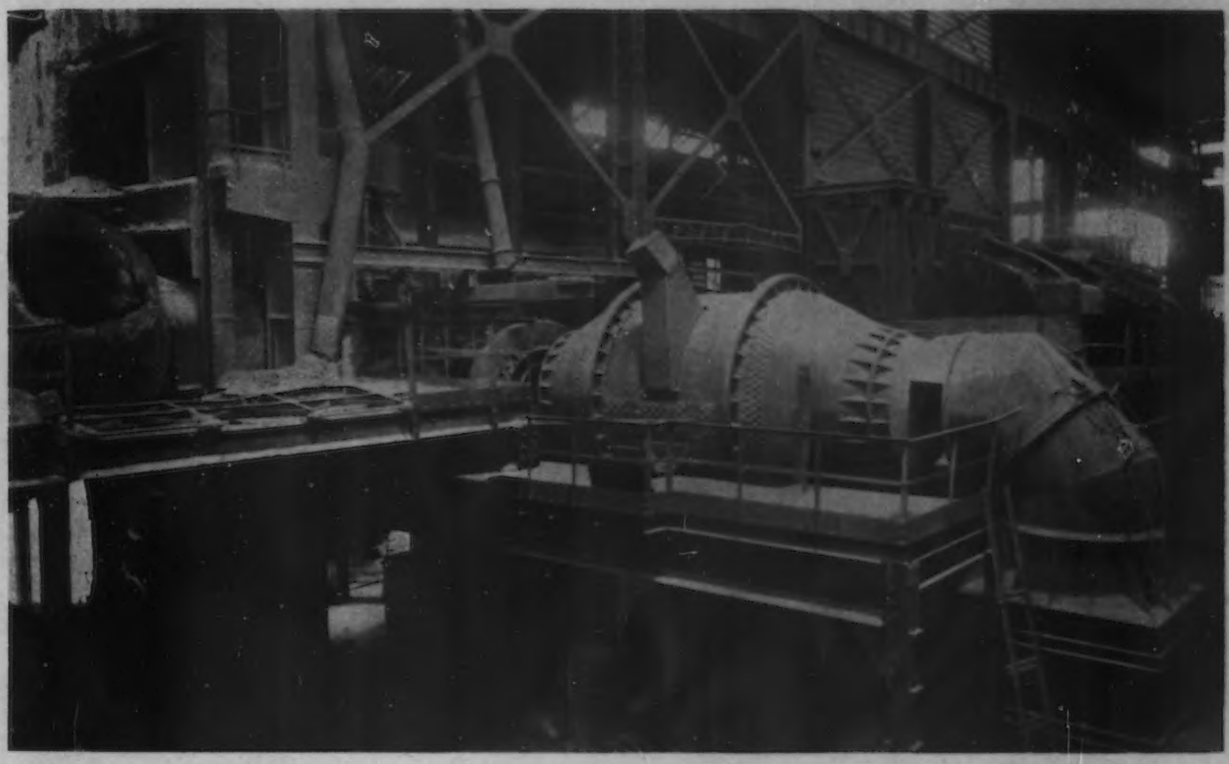
problem involves the study of a series of details together with the education of the personnel to insure the constancy of the operations and their automaticity; for if the same conditions of operation are always repeated, constant results will be assured.

A very important item is a good elimination of the acid slag, so that from one operation to the other, substantial variations of acid slag getting into the basic slag-containing ladle are avoided. The practical instantaneous dephosphorization of bessemer steel is today a problem whose solution is merely mechanical.

In addition to the foregoing, recent developments have shown the possibility of dephosphorizing pig iron without substantially decarburizing it. This should allow the manufacture of hematite type pig iron starting from a pig iron very rich in phosphorus, the duration of such operations being always extremely short. Of course, a parallel de-siliconization of the pig iron occurs, and such a de-phosphorization can only be envisaged in connection with a cold blast furnace practice for a low silicon content, with a corresponding economy of coke. Besides, the recovery of commercial phosphorized slags should be possible.

The economical advantage of such an operation seems to be essentially a function of local conditions and the grade of ores, the latter with regard to the content of iron oxide and, principally, of phosphorus. I cannot have an accurate opinion as to the possibility of such an application in the United States —I merely mention it without comments.



THE rotating oil-fired slag furnace used at Valenciennes. At the outlet of the furnace, combustion gases go through a metallic recuperator, thus allowing a re-heating of incoming air up to a temperature of around 1290 deg. F.

Deoxidization

As has already been stated, the primary aim of all our work on the deoxidization process is the regular and automatic production of good quality of steels with a low oxygen content by means of an ultra-rapid practice starting from cheap and highly oxidized molten steel.

However, this does not mean that the Ugine-Perrin process cannot find application in the manufacture of steel where very low oxygen contents are not sought, this being the case in the acid or basic bessemer converters. On the contrary, industrial experiments are going to start in the near future on the manufacture of such steels starting from the bessemer converter, with the view of producing for certain uses the grades of steels made, up to now, only in the open-hearth furnace.

But the reader can easily see that it was a natural thing for a manufacture of alloy steels to do, having conceived the processes in view of the initial Ugine-Uckange Works scheme, i.e., to investigate the manufacture of steels with low oxygen contents.

Furthermore, the reader may be sure that I am aware of the fact that the conception of the manufacture of high quality steels in a few minutes, starting from over-oxidized steels, is critically questioned by many metallurgists.

In the production of fine steels, it has been the general aim to oxidize the metal as little as possible before proceeding to its final deoxidization, either in the acid or basic open-hearth, where the starting material is high-manganese pig iron, or in the electric furnace. In the latter practice, the American procedure consists in charging

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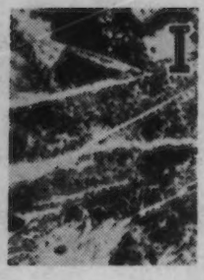

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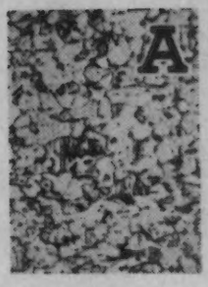
METALLURGICAL ASSISTANCE



ASIDE from putting every effort into making Ferro-Alloys well adapted for producing quality irons and steels, it is the desire and aim of the *Ohio Ferro-Alloys Corporation* to be of real assistance to the producers of iron and steel in meeting the ever growing demands placed upon them by competition and the advancement of the consuming industries.

"Change is, after all, the most consistent and characteristic quality of business. New inventions and discoveries lead to the obsolescence of older processes and methods. Competition forces improvements and short cuts."

During the past twenty-five years a great many changes have taken place in the iron, steel and alloy industry. Through all of these changes, however, the Ferro-Alloys of Manganese, Silicon and Chrome have always retained their important positions. The manner in which they have been used in the various processes or methods of manufacture of iron and steel has varied considerably, and will continue to vary in order to meet a wider diversity of products and stricter requirements.

The representatives of the *Ohio Ferro-Alloys Corporation* are well equipped to assist in obtaining satisfactory solutions to problems facing users of Ferro-Alloys. Their service is based upon constant association with such problems, and upon past experience in the actual production of iron and steel.

To you they offer, in good faith, whatever service your problems demand.

"Nothing in the world can take the place of intelligent persistence. Talent will not; Nothing is more common than unsuccessful men with talent. Genius will not; Unrewarded genius is almost a proverb. Education will not; The world is full of educated derelicts. Persistence and determination are omnipotent. The slogan 'PRESS ON' has solved and always will solve the problems of the Human Race."—Calvin Coolidge.

Ohio Ferro Alloys Corporation, Canton, Ohio

selected and clean scrap, to melt this scrap, and then proceed to a long deoxidization process carried out under a carbide slag.

Also I am aware that a number of distinguished metallurgists are of opinion that this slow practice is the only one that is permissible in view of obtaining a good micrographic cleanliness of the steels, and that a rapid deoxidization of over-oxidized steels can never lead to the same results.

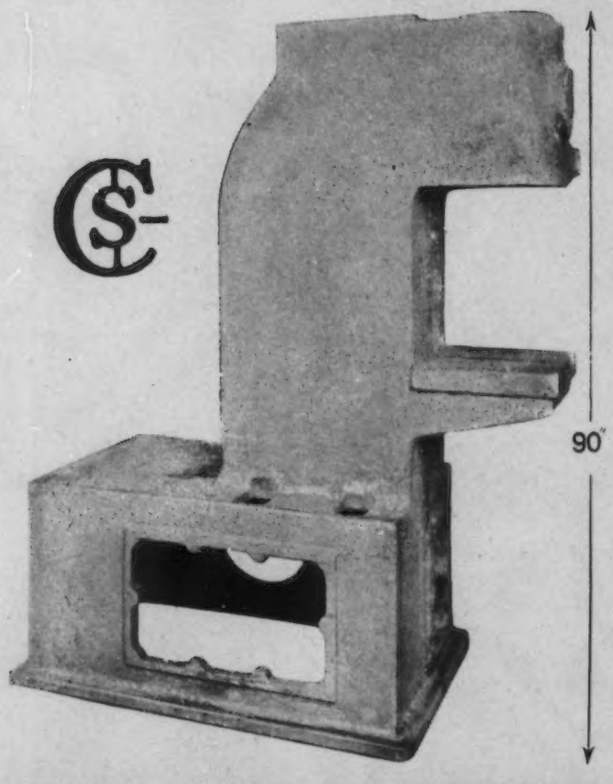
However, experience has shown us that it is quite possible with the Ugine-Perrin process to obtain steels fulfilling the requirements of European users perfectly, such steels being of a very good micrographic cleanliness. Therefore any attempt to reach a higher degree of cleanliness seems to me to be a kind of performance with not much practical justification. As a matter of fact, I do not see what advantage such performance would bring to the behavior of steels in commercial service, which is, after all, the only criterion of real moment.

I think that the best means to support my opinion is to describe the application made in two definite cases. The electric furnace at Ugine and the basic bessemer converter at Valenciennes—Northern France—and to give some of the resulting figures.

Ugine Electric Furnace

When I started my studies, I had only in mind the application of the processes to the basic bessemer converter, and I had not at all in view their application at Ugine, simply because such adverse conditions were to be met with at Ugine.

Ugine buys scrap, the major part of which has a rather high phosphorus and sulphur content, averaging 0.05 and 0.04 per cent respectively—and the recovery of its own scrap is in the neighborhood of 20 to 30 per cent in weight of the ingot. The former desulphurization practice at Ugine was made under white slag, simultaneously with deoxidization and dephosphorization, and it was, as usual, made during the melting down of the scrap. The replacement of the deoxidization under carbide slag by a violent mixing with acid slag obviously did not accomplish a sufficient desulphurization to fulfil the requirements of our high grade steel manufacture. Consequently, I thought at the start, that this process was not going to be applicable at Ugine. I simply had in mind to run there a few experiments on a sufficiently large scale in order to actually carry out deoxidization through acid slag. But I was somewhat hindered by the fear of manufacturing excessive tonnages with too high a sulphur content, which could not find an outlet on the market without prejudice to our reputation. After the first experiments, when I found that such an amount of desulphurization was achieved at the same time as dephosphorization in the ladle, I had the idea that it could be made completely possible, provided a proper selection in the composition of slags was made to desulphurize and dephosphorize at the same time in an oxidizing atmosphere during the process of melting down the scrap. We started the study of this problem with the most valuable help of my associ-



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ates, and we rapidly succeeded by using slags with a high iron oxide content and a low silica content. But this result was attained only with a very high over-oxidization of the steel—the oxygen content of the molten bath when slagging off ran from 0.07 to 0.12 per cent.

These results encouraged us in the possibility of running new experiments at Ugine on a larger scale, and at the same time, the situation was simplified a great deal by our finding a commercial market outlet for the metal. But, as soon as we ran into a practical application of our processes, we found out that they resulted in a valuable and powerful means of investigating other technical factors.

The new practice allowed us to study the variation of one factor at a time, owing to the fact that the process was instantaneous, just like a chemical reaction, whereas, with our previous practice, we were almost sure to have secondary reactions. Thanks to a systematic investigation, based on the principle of the variation of one single factor at a time, we very quickly acquired some ideas, quite new for us, on a number of fundamental problems regarding the metallurgy of high grade steels, all of which were more or less dependent on the state of oxidation of the steel; for instance, the nature of inclusions, hair lines, grain size, abnormality, physical properties, lengthwise and transverse, depth of hardening, etc. In two years' time we progressed in the knowledge of these fundamental problems of steel much more than we had in the previous 15 years, thanks to the most efficient work of my associates and the facilities that arose from the application of our processes.

Conditions Standardized

Those ideas gave us at the same time the conviction that the Ugine-Perrin processes were an excellent means of automatically duplicating at will the desired steel characteristics, which was not possible with our previous practice in the electric furnace. As an example, we obtained considerable improvement regarding hair lines. Since the Ugine-Perrin processes also resulted in a gain in time and a saving in the cost price, the extension of that practice to the whole plant was made the object of our efforts. We had to determine for every one of the many grades of steels we

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sell, the best operating practice according to the results specifically sought. These results often vary for the same grade of steel, according to the customer or the use. Our investigations showed, namely, that the obtaining of an optimum given result for a given property would often enhance a worse condition regarding another given property and that an arbitrary discrimination had to be made. In other words, there is no such thing as a steel able to give at the same time the maximum of all the properties that may be desirable. Quality of steel cannot be given a standardized definition—different steels have different properties that qualify them for such and such a use.

Together with the research of the best practice for every case, we tried to improve the properties of our steels. For this purpose we availed ourselves of samples of European steels enjoying the best reputation for every given use; there were Swedish steels for certain applications, Czechoslovakian steels for others, or German or English steels for still other specialized applications, etc. We then determined the most suitable practice to faithfully duplicate the properties of such steels, thus developing around our processes an altogether new technique. Thus, we were able to manufacture at will and regularly, by an automatic procedure, the most suitable steel for each and every use.

As far as we are concerned, this has been a new conception, entirely different from our former ideas of steel manufacture. Previously, we used to run heats that were conducted according to the initiative of the operators following general directions — then the laboratory classified the heats, discriminating amongst them and appropriating each one to such or such customer according to his requirements. Naturally, the practice was somewhat approximative in all its respects. In the case of Ugine-Perrin processes we have gradually built up the technique of planning our steel operations, and the furnace operator has only three items to consider: to obtain the desired carbon content, to secure the desired temperature for a given grade of steel, and to see that a proper slagging off of the molten slag is made. For every heat the operator receives, he secures a voucher with precise instructions to be adhered to which results in the obtaining of steel with the required properties. After quite a long experience with this practice, I can assert that the results of this technique have had considerable and favorable consequence for us.

The slag is melted in a simple and sturdy electric furnace, entailing a very low maintenance cost. The average consumption of slag is 3 per cent of the weight of the treated metal. For a heat of mild steel—for instance, case-hardening nickel-chromium-molybdenum steels —the process is as follows: First the melting of the cheapest available scrap, the addition of nickel and a simultaneous dephosphorization and desulphurization under an oxidizing basic slab; then the bath is brought up to a pouring temperature and carefully slagged off; immediately after slagging off the foreman consults the clock and, fol-

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Machinability	easier by 25 to 40%	not quite so easy
Tensile Strength	comparable	greater
Usable Strength	greater than low C. about equal to .35C	greater
Elongation	less	less
Surface Hardness	greater	much greater
Ductility	enough to withstand average shock loading	

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• If you figure carburizing costs on a part basis, Chrome-Molybdenum (4120) carburizing steel will save several cents per part.

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MOLY

lowing the instructions written on the voucher, proceeds to the addition of cold ferroalloys; then after a total time interval of nine minutes, the ladle—which in the meantime has been fed with the necessary amount of acid slag—is brought under the furnace and the pouring takes place. From over-oxidized steel to finished steel, the operation has lasted nine minutes, and no slag has been re-charged. That nine-minute time interval could even be shortened by liquid ferroalloying additions, but this is of no interest in the case of the electric furnace.

A very thin film of slag is formed, after the addition of alloying elements, but this does not come into account, because that small amount of slag is mixed with the acid slag when the violent intermixing occurs and comes into equilibrium with the metal, so that the final yield in chrome for instance, is not at all influenced by the slag film. In the case of high-carbon steels, to the nine minutes previously mentioned, there must be added the necessary time to obtain the proper carbon content of the bath.

I have described the operation as conducted with our existing equipment, but in the near future—thanks to a modernization of our melting means, and the acceleration of certain operations, such as carbon conditioning—we shall have a very rapid technique for producing steels with pre-determined properties. We confidently believe it might be possible to run seven to eight heats a day, of 20 tons each, in a furnace starting from cold charges. Thus the total time required for an entire operation, from cold scrap to finished steel, would be somewhat the same as the time required for deoxidization only in certain works.

Physical Properties of the Steel

To some people it may seem more or less impossible to manufacture high grade products under such conditions. I don't think so, at least as far as European customers are concerned. The criterion of quality is apt to vary in its essence from one country to another, and even from one plant to another in the same country. Personally, I am convinced that the actual industrial problem is not to seek the accomplishment of a high standard product from time to time, but essentially to automatically repeat a regular flow of products that will be exactly suited to the needs of the users. For information purposes, I am giving in the following paragraph and in the accompanying table a few examples of the results obtained on the commercial manufacture of two grades of steel, as regard chemical composition and physical properties on the one hand and micrographic cleanliness on the other.

The data shown in the accompanying table indicate the analyses and physical properties, with the view of classifying ten heats of a commercial semi-hard nickel-chrome steel. The mechanical tests have been made according to French specifications, i.e., test pieces of 13.8 mm. for tension tests and Mesnager notched specimens for impact tests.

Rating of Inclusions

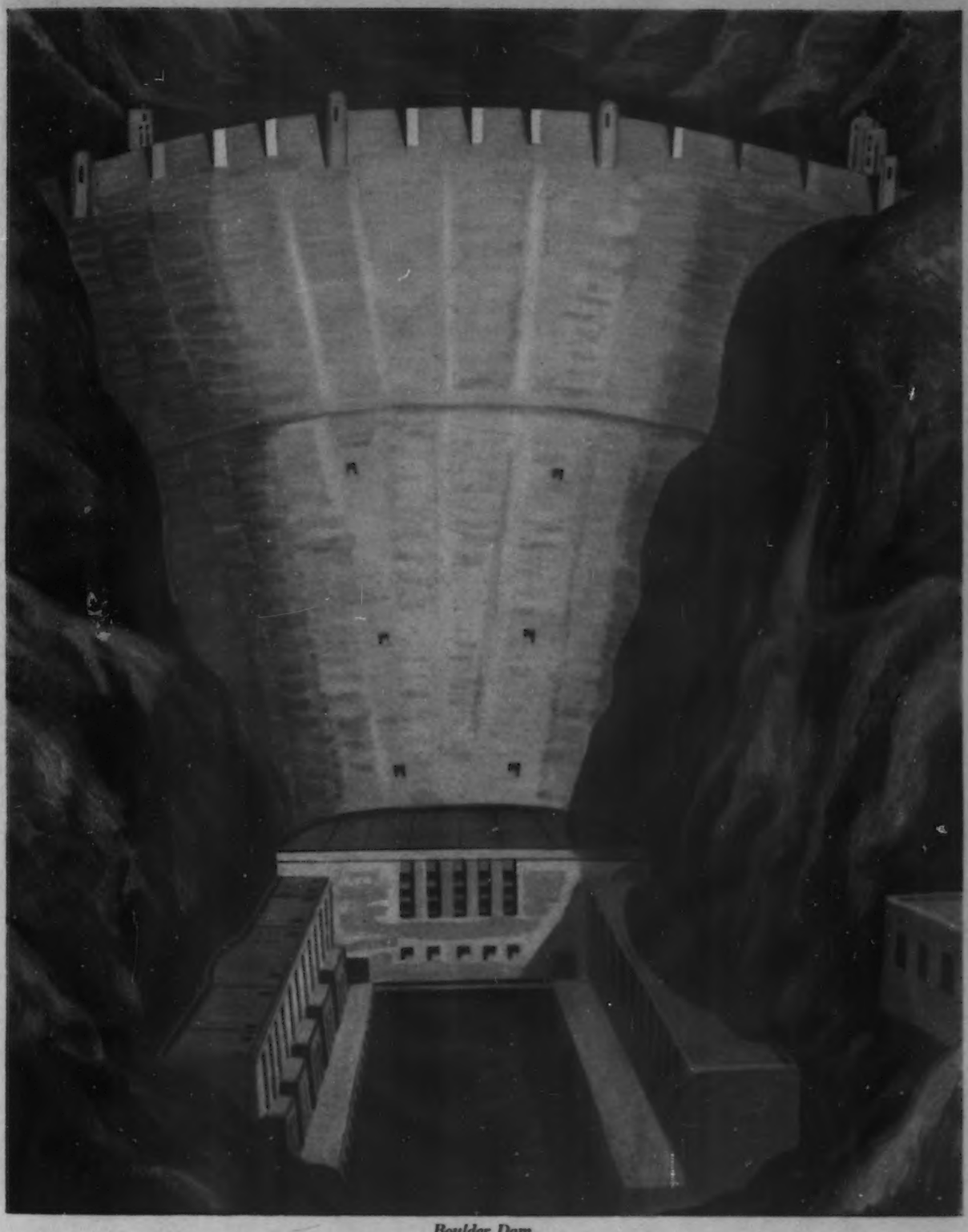
The known methods of rating inclusions vary to considerable extent. At Ugine, we use the following method, originally developed by my associate, H. Jolivet.

The ingot is rolled into 80 mm. billets, and a transverse slab of 10 mm. thickness is taken from the middle. The sections of the slab submitted to examination are two lengthwise axial semi-sections parallel to the sides and perpendicular to one another.

On each of the sections, two continuous strips of the width of the microscope field are examined, extending from the outside to the axis. The microscope field is 1.76 mm. at a 100-diameter enlargement. The dimension of the inclusion encountered is rated in number of divisions of the ocular mi-

ANOTHER view of the basic bessemer steel plant at Valenciennes. The rotating oil-fired slag furnace is shown in the background. By direct pouring from a basic bessemer, killed steels have been obtained with oxygen contents as low as those produced normally in an open hearth or electric furnace.

A Great Engineering Achievement



Boulder Dam

Never in the history of human progress has there been a more ingenious engineering achievement than the famous "Boulder Dam." Built in solid rock, with thousands of tons of concrete, reaching upward in fan-like splendor; this giant bulwark accomplishes the impossible, in harnessing the mighty Colorado River. Natural power once wasted, now serves a useful purpose.

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crometer. One division equals 0.176 mm.

The inclusions are divided into the following groups: Group I, 4 to 10 divisions, with dimensions of 0.07 to 0.17 mm.; Group II, 10 to 20 divisions, with dimensions of 0.17 to 0.35 mm.; Group III, 20 to 40 divisions, with dimensions of 0.35 to 0.70 mm.; Group IV, 40 to 100 divisions, with dimensions of 0.70 to 1.76 mm.; and Group V, over 100 divisions, with dimensions of over 1.76 mm.

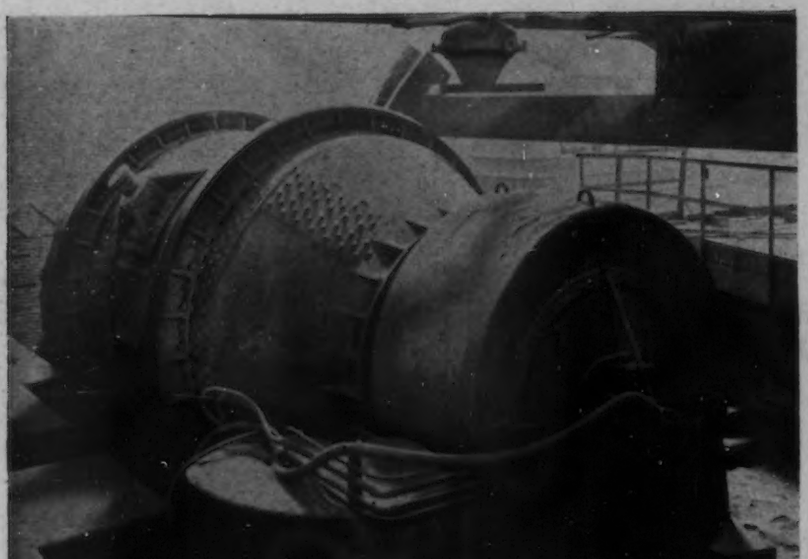
For every sample, in each group, four figures were taken which correspond to the four strips under examination, and an average was taken. Experience shows that the dispersion between the four partial values is relatively small. This classification, however, shows a certain dispersion due to the fact that only one slab is adopted (for study we adopted several slabs), but we consider that one is sufficient as a means of controlling the manufacturing operations.

The following shows the results of this classification for 48 successive heats of ball bearing steels, according to our rating process. Of course, for this kind of steel we seek the maximum micrographic cleanliness:

The average of the 48 heats showed 8.5 for Group I, 0.85 for Group II, and less 0.1 for Group III. The best heats showed 3 for Group I and 0.5 for Group II in one case, and 6 in Group I and 0 in Group II in another case. One of the most defective heats showed 12 in Group I, 2 in Group II and 0 in Group III, and another defective heat showed 11.5 in Group I, 1 in Group II and 0.5 in Group III.

These figures apply to our standard 500-kg. ingot, and are the result of a long systematic study. I give them as such mainly to show the regularity of the figures. I am wondering whether it is possible to obtain something still more regular, but I know positively that this is much better than what we used to do formerly on steels in conventional practice, for which our manufacturing experience ran over 30 years. Our commercial experience also shows that such steels, as made by the Ugine-Perrin process, correspond perfectly to the needs of customers.

I am wondering if it would be any use improving these figures, and if such improvement would accomplish something real in the way of industrial progress, or whether it would merely mean a useless expenditure of money and effort.



ANOTHER view of the rotating oil-fired slag furnace at Valenciennes. Acid slags obtained from this furnace are extremely fluid, and are every bit as hot as those obtained from the electric slag furnace at Ugine. Temperatures as high as 3100 deg. F. are obtained easily.

Basic Converter

Owing to adverse conditions independent of the industry, the application of the Ugine-Perrin process to the basic converter is rather recent.

It may be stated that the manufacture of highly deoxidized quality steels, starting from the basic converter and without transferring into another furnace, represents the maximum of difficulty. The many difficulties to be overcome include over-oxidization of the steel to reach the required dephosphorization, difficulty of properly desulphurizing, difficulty of temperature control with no possibility of bringing heat from the outside, unfavorable influence of high temperature on dephosphorization, the presence in the converter of over-oxidized slag with a high P_2O_5 content running around 15 per cent which hinders an efficient deoxidization in the converter unless rephosphorization occurs, etc. On the other hand, when mixing with acid slag, any fraction of the converter slag going through would involve an immediate rephosphorization.

Nevertheless, I believe for the first time in the world, we have succeeded, in collaboration with Aciéries du Nord et de l'Est in Valenciennes, to obtain, by direct pouring from the basic bessemer converter, killed steels with low oxygen content that are comparable to sheets normally produced in open hearth or electric furnaces.

Operating Technique

The operation consists first in a complementary dephosphorization after slagging off, by loading a slag into the converter, which is followed by a very short blowing. Then spiegel or ferro-manganese, in liquid state, is charged into the converter. The content in carbon is figured according to the required carbon content of the finished steel. The manganese content is arranged so as to obtain in the converter a bath with about 0.4 per cent manganese over the required content in the finished metal. A dam is built up on the spout of the converter

INDEX OF VOLUME OF SALES

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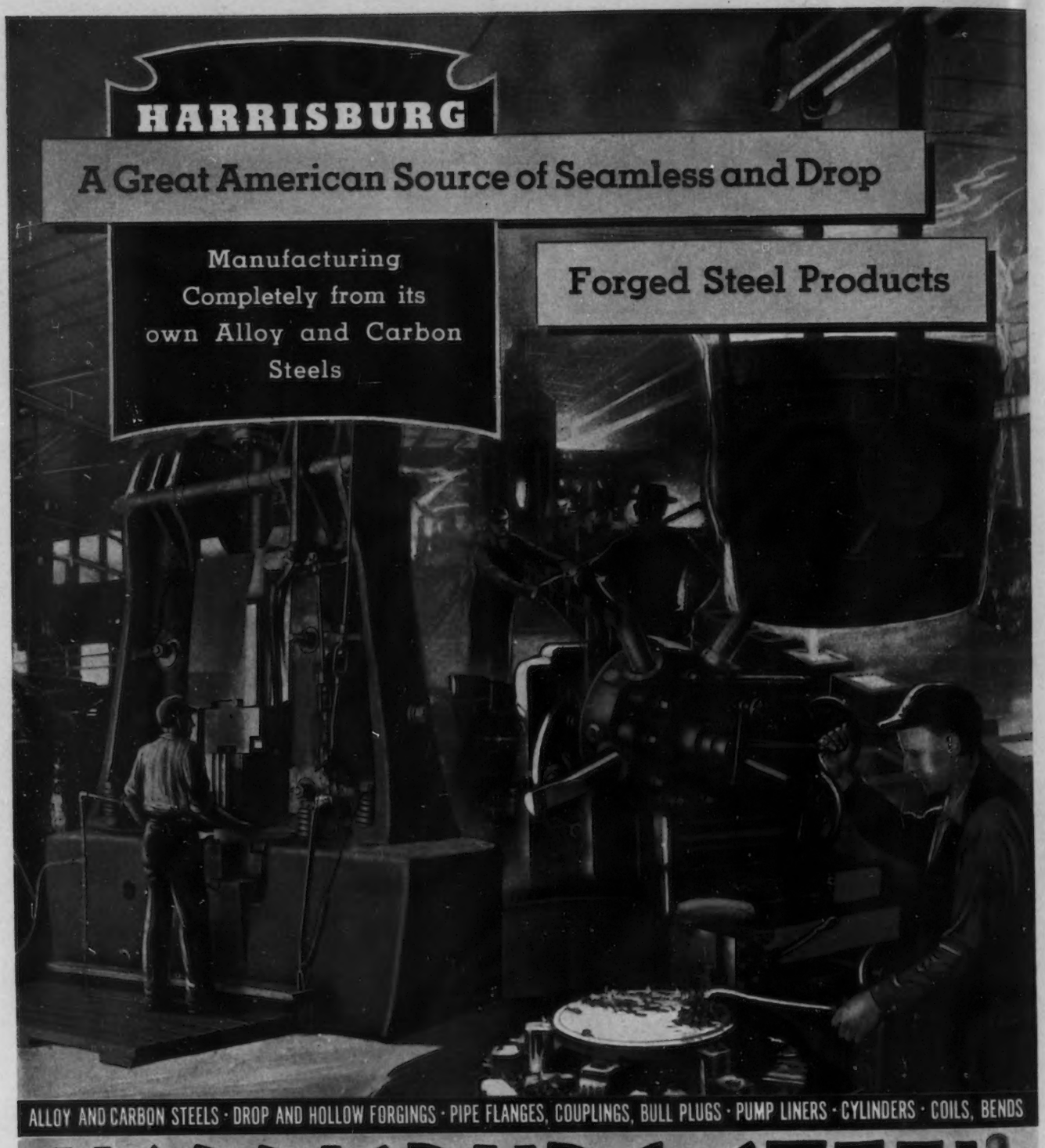
INDEX OF VOLUME OF SALES

SALES OF MO-MAX BY 3 MONTH PERIODS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by heaping some lime on it. The object of this dam is to keep back the slag when the converter is being rapidly tilted in view of the pouring of the steel into the acid slag. The acid slag is melted in a rotating oil-fired furnace that has been developed and built by the Société des Fours et Fumisterie Industrielle. At the outlet of the furnace, combustion gases go through a metallic recuperator thus allowing a re-heating of incoming air up to a temperature of around 1290 deg. F. Such a furnace is capable of reaching very high temperatures, as high as 2910 or 3100 deg. F. Acid slags thus obtained are extremely fluid and as hot as those melted in our electric furnace at Ugine. Teeming of the ingots is made with an addition of aluminium.

The following paragraphs give a few results of two heats of plain carbon steel similar to American axle steel in 2250 kg. (2½-ton) ingots:

Heat No. 1

The analysis of heat No. 1 was 0.43C, 0.08Si, 0.9Mn, 0.022 S, and 0.027 P. The Mesnager impact value was 7.5 when the steel was normalized at 1600 deg. F. (for a Brinell hardness of 200); the Mesnager impact value was 13.5 for the steel when water quenched from 1560 deg. F. and annealed at 1112 deg. F. (for Brinell hardness of 255). The total oxygen in the center of the bottom of the ingot (highest oxygen-containing zone) was 0.005 per cent.

Heat No. 2

The analysis of heat No. 2 was 0.37C, 0.7 Mn, 0.12 Si, 0.026 S, and 0.028 P. The Mesnager impact value was 18.4 when the steel was normalized at 1600 deg. F. (for a Brinell hardness of 175); and the Mesnager impact value was 21 when the steel was water-quenched from 1560 deg. F. and annealed at 1112 deg. F. (for a Brinell hardness of 229). The total oxygen content in the center of the bottom of the ingot was 0.006 per cent.

The average of inclusion ratings that we made on the bottom of such ingots of steel of this type with an addition of 0.012 per cent aluminum in the molds showed 15 of a 4 to 10 divisions length, 2 of a 10 to 20 divisions length, 0.5 of a 20 to 40 divisions length and 0.2 of a length greater than 40 divisions.

These figures are quite different from those generally found for ordinary basic bessemer steels of the same type. From this I think we can conclude that it is possible, by direct pouring from the basic converter, to manufacture clean steels, and I further believe that it is likely that such results may still be improved.

Basic Bessemer Quality Steels

Though there is no basic converter in the United States, I thought it was of some interest to mention the foregoing figures to give an idea of what it is possible to do with the acid converter. I do not doubt that deoxidization of steel is easier with the acid converter than with the basic converter. Obviously, there remains the same problem of a proper elimination of slag which we encountered and solved in the case of the basic bessemer, but such a problem can find a solution by mechanical means easy to realize, even though a small fraction of slag might go through. Personally, I would prefer to have to deal with oxidized acid slag of the acid bessemer than with the highly oxidized phosphorus basic slag from the basic converter. Moreover, it is easy to attain, in the acid converter, a high temperature, or even a very high temperature, which is a very favorable condition for the application of our process.

It is my absolute conviction that it is possible, by using only the basic converter, to manufacture high-grade steels, whether they be carbon steels or alloy steels; and paradoxical as it may appear, it seems to be an easier problem with the acid converter than with the open-hearth furnace, because of the possibility of getting a proper temperature in the former. Regarding the application of our process in the open-hearth furnace, I believe the securing of good results is governed by the possibility of eliminating the open-hearth slag without having to transfer the steel into an intermediate ladle—experiments have been carried out in European steel works which show that it is possible to commercially hold back the slag from the furnace.

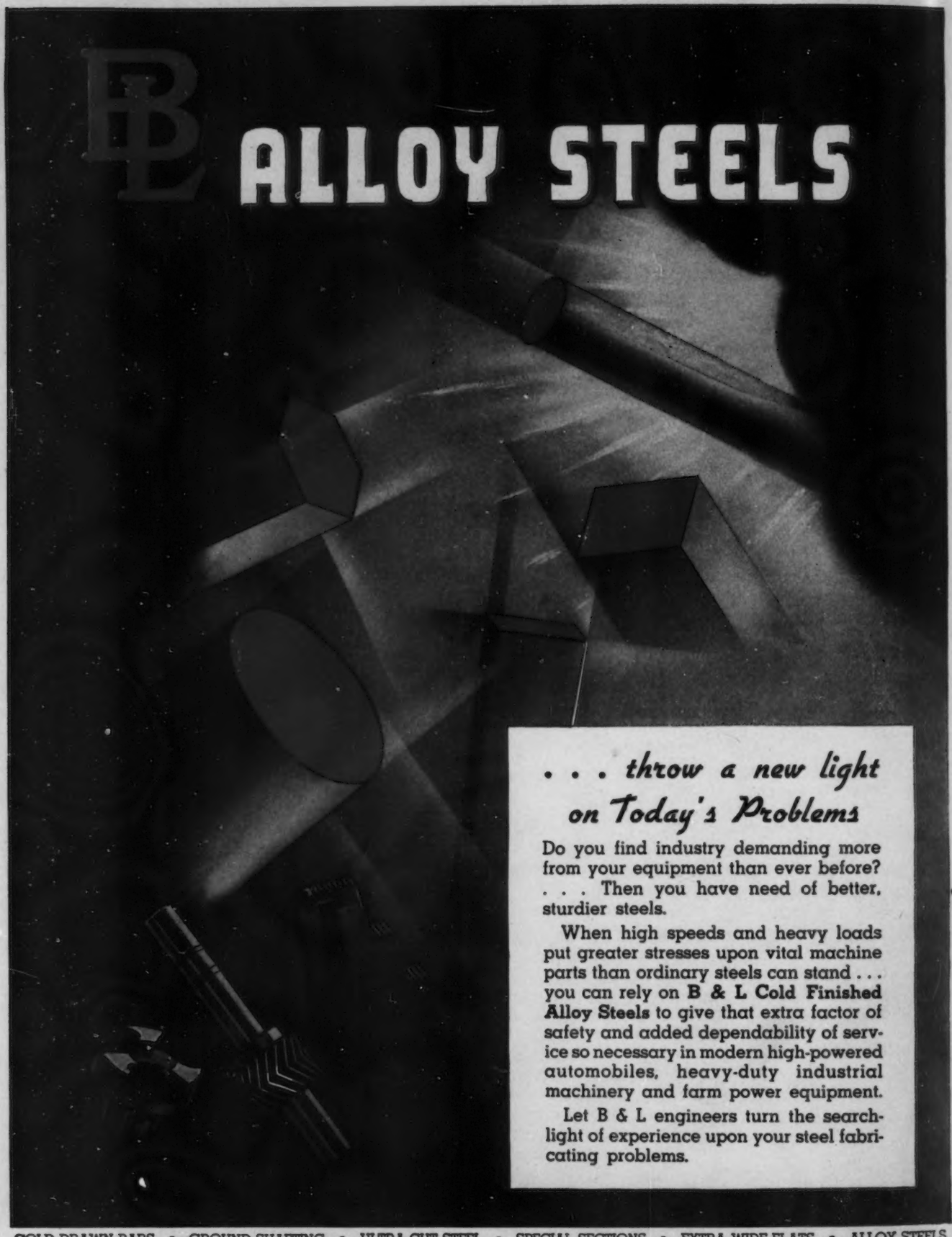
Conclusion

I have attempted to outline the present state of the Ugine-Perrin process technique and the results obtained. I trust that in the near future they will be applied to purposes other than the deoxidization of steel.

I am not in a position to make any additional statements other than saying that these processes can be used for dephosphorizing or desulphurizing steel in the United States. The most interesting exchange of views I have had with distinguished American metallurgists does not suffice to give me a well-founded opinion on the technical problems and the economic conditions that are to be met. I am merely trying to have the American metallurgists thoroughly understand what our processes and their possibilities are, leaving it to them to see how they can be applied. However, I may state—following 17 years' experience in one of the oldest and largest electrical steel works of the world that has been manufacturing all the varieties of high-grade steels and that enjoys, if I may say so, a good reputation in Europe—that if I could avail myself of bessemer steel I would not attempt to melt selected scrap in an electric furnace. I know that electric current is an expensive fuel; consequently, either through dephosphorizing bessemer steel in a ladle followed by a short stay for proper conditioning in an electric furnace, or by using the acid converter itself, I would attempt to lower the cost price of high-grade steels by intensive production with a minimum of investments to the ton produced and the least expense of power, labor, etc., with the conviction that I would reach the desired result.

Automatic Schedules

At Ugine, we have not only, with a very rapid technique, satisfactorily deoxidized over-oxidized steels by melting the cheapest low-grade scrap, but, at the same time, we have been able to pre-arrange an automatic and regular practice with the most economic conditions of cost price—taking into account our raw materials and equipment—for producing steels with pre-determined physical properties. This has been done for carburizing steels, carbon or alloy structural steels, tool steels, file steels, mining drills, ball-bearings, etc., all of which thoroughly comply with European specifications; and commercial experience has proved that the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When high speeds and heavy loads put greater stresses upon vital machine parts than ordinary steels can stand . . . you can rely on B & L Cold Finished Alloy Steels to give that extra factor of safety and added dependability of service so necessary in modern high-powered automobiles, heavy-duty industrial machinery and farm power equipment.
Let B & L engineers turn the searchlight of experience upon your steel fabricating problems.

COLD DRAWN BARS • GROUND SHAFTING • ULTRA-CUT STEEL • SPECIAL SECTIONS • EXTRA WIDE FLATS • ALLOY STEELS

BLISS & LAUGHLIN, INC.

HARVEY, ILL. *Sales Offices in all Principal Cities* BUFFALO, N.Y.

Calling all flat wire specs in the "REAL TOUGH" *class*

WE make cold-rolled steel flat wire... high and low carbon ...for a host of "hard-to-please" users of this product.

All of these users have exacting requirements. Some demand great toughness and resiliency . . . others uniform temper, held within very close limits. Exceptional dimensional accuracy, freedom from defects on surface and edges, ability to withstand severe drawing strains . . . are a few of the other specifications we are constantly called on to satisfy.

Are your flat wire specs in the "real tough" class? If so, you are sure to be interested in our services and products. For over 40 years we have specialized in this type of business and have special facilities to handle it.

We invite your inquiry for further data, prices or samples.

Types:—Roebling Cold Rolled Flat Wire is made from both high carbon and low carbon steels, produced in Roebling's own mills.

The high carbon flat wire is available in tempered and untempered types.

Finishes:—bright, black annealed, bright annealed, tinned, galvanized, blued, straw-colored, coppered.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, N. J. *Branches in Principal Cities*

Roebling COLD ROLLED STEEL FLAT WIRE

John A. Roebling's Sons Co.
(Mail to Trenton, New Jersey or nearest office)

☐ Please mail me copy of your Flat Wire Catalog
☐ Have your representative call.

Name .....
Company .....
Street .....
City and State .....

customers were quite content with the excellent results obtained, which showed on an average a definite improvement over our former steels. All this has been accomplished by the Ugine-Perrin processes. Is it possible to obtain the same results with other processes? Of course, I would not dare say that it is not possible, but I think I am entitled to state that the Ugine-Perrin processes have given us a simple and automatic solution of a problem which, to my mind, represents what industry has long been seeking.

Welding of Mechanical Equipment

(CONTINUED FROM PAGE 111)

There recently was let for construction certain equipment for loading coal into ocean boats. The purchaser stated that although the design was satisfactory, its weight was entirely too great to be safe for operation on the existing pier, inasmuch as the pier had been built years before for light-weight equipment. The equipment was redesigned, substituting abrasion-resisting, high-strength low-alloy steel for those parts coming in contact with the coal to be handled, and for the balance of the structure low-alloy corrosion resisting high-strength steel was used. The reduction in weight was highly satisfactory to the customer. This is just one example of a contract involving hundreds of thousands of dollars being obtained through the use of weight-reducing materials. In the construction of this coal-handling equipment, there were used the largest beams of high-strength steel ever rolled. The cooperation of one of the large producers of steel in the selection of materials for this low-weight equipment was splendid, even to the extent of making a sample rolling to make sure that 30-in. beams over 50 ft. in length could be made of the material chosen (see Fig. 9). It is interesting to note that all of this special steel was also corrosion resisting.

The extensive tests of rolling stock now being conducted by leading railroads will, without a doubt, develop designs incorporating weight saving steels that will prove of great value in reducing future motive power operating costs. This is one of the most promising fields for the new low-alloy steels. No doubt increased tonnage will make lower costs possible, and this will in turn speed the wider use of low-alloy steels.

The ultimate scope of welding in the building of mechanical equipment is largely a commercial consideration. The trade will always be willing to pay more for a superior product but in those fields where castings are now satisfactory or where riveted structures are acceptable, the choice of the purchaser will be mainly on the basis of price. While great prog-

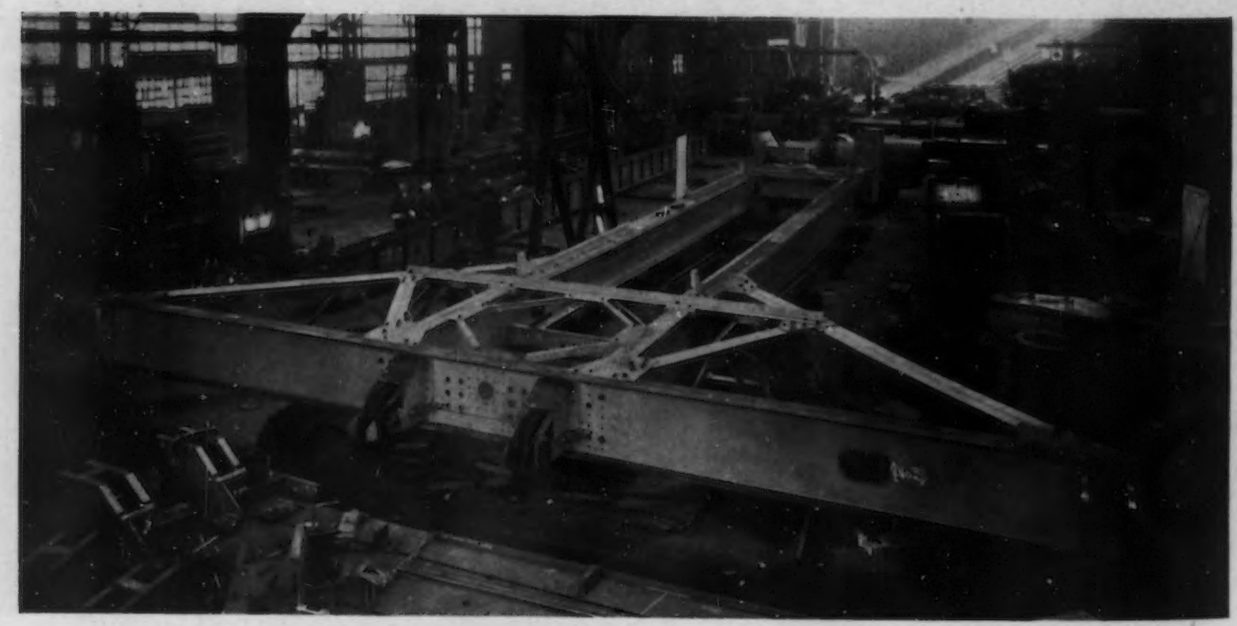


FIG. 9—One of three wall crane coal loading tower booms made of Cor-Ten, high-strength, corrosion-resisting steel. These 30-in. beams, over 52 ft. long, are the largest high-strength beams ever rolled.

MEEHANITE

IN THE *Steel* INDUSTRY

IMPROVED CONSTRUCTION
DECREASED MAINTENANCE
BETTER OPERATION
LOWER COST

Meehanite is constantly developing a wider use in steel mill applications because it pays financially and gives satisfaction.

Applications—

MILL HOUSINGS
PINCH ROLLS
WIRE BLOCKS
SPROCKETS—SHEAVES
GEARS
TABLE ROLLS
COUPLINGS and SPINDLES
REELER PLUGS
BAR MILL GUIDES
SLABBING GUIDES
REELER GUIDE SHOES
HEAT RESISTANT PARTS
SOAKING PIT COVERS
GALVANIZING POTS
HEAVY DUTY PLUNGERS
HEAVY DUTY CYLINDERS
BLOOMING MILL TABLES
BLOOMING MILL BED PLATES

MANUFACTURERS:
American Laundry Machinery Co..Rochester, N. Y.
Banner Iron Works.....St. Louis, Mo.
H. W. Butterworth & Sons Co.....Bethayres, Pa.
Cincinnati Grinders Incorporated..Cincinnati, Ohio
The Cincinnati Milling Machine Co..Cincinnati, Ohio
Cooper Bessemer Corporation.....Mt. Vernon, Ohio
Crawford & Doherty Foundry Co...Portland, Oregon
M. H. Detrick Co.....Peoria, Ill.
Farrel Birmingham Co.....Ansonia, Conn.
Florence Pipe Foundry & Machine Co.
(R. D. Wood Company, Philadelphia, Selling Agents)

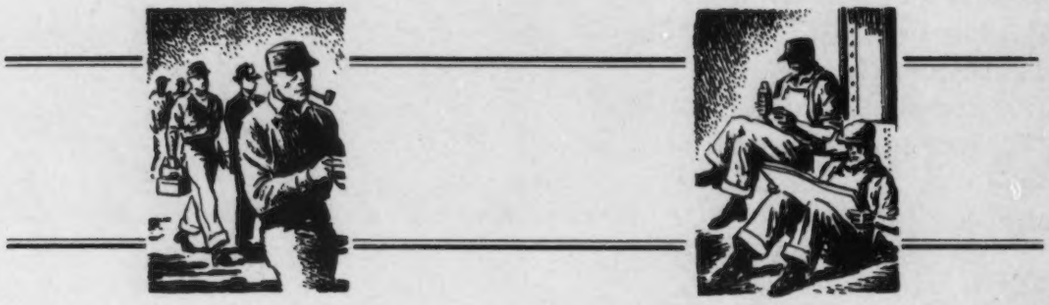
METAL

Fulton Foundry & Machine Co.....Cleveland, Ohio
G.H.R. Foundry Co.....Dayton, Ohio
Greenlee Foundry Company.....Chicago, Ill.
Hamilton Foundry & Machine Co...Hamilton, Ohio
Kanawha Manufacturing Co...Charleston, West Va.
Kinney Iron Works.....Los Angeles, Calif.
Koehring Company.....Milwaukee, Wis.
Michigan Valve & Foundry Co.....Detroit, Mich.
Rosedale Foundry & Machine Co...Pittsburgh, Pa.
Ross-Meehan Foundries.....Chattanooga, Tenn.
Vulcan Foundry Company.....Oakland, Calif.
Warren Foundry & Pipe Corp...Phillipsburg, N. J.
Washington Iron Works.....Seattle, Washington

ress has been made in the reduction in cost of welding equipment and supplies, the future of welding depends upon industry's ability to produce equipment by this method cheaper than with any other method of production. The fixturing of work to facilitate welding, the positioning of a part to enable the welder to work to advantage, all have proved their advantages for low labor cost. Fig. 8 illustrates the use of fixtures not only to save fitting up and welding time but to insure exact alinement of parts entering into a completed weldment. Naturally, such expensive equipment can only be made for work of considerable volume, but the possible labor saving is enormous and interchangeability of parts is assured. However, these are but incidental aids. Engineers must, and without question will, devise new methods of welding which will greatly reduce the cost. Promising developments have been made with the use of loose flux, large diameter bare electrodes and high-amperage current, but this procedure necessitates long run welds on heavy material.

To those organizations which have made a half hearted attempt at welded construction, or to those considering its use, we suggest that welding development and fabrication be put under the supervision of an executive with authority to act on his own responsibility. It is asking too much to expect rapid developments from a foreman who has to fight up through several superiors to purchase equipment costing a few hundreds or thousands of dollars. In many instances, particularly in production lines, the employment of a welding consultant is by far the cheapest procedure in the final analysis. Much valuable time may be saved and costly errors prevented thereby. Welding is as exact a science as casting or rolling steel, and the fundamentals cannot be mastered over-night. Competent counsel in welding is as essential as it is in any other phase of business.

There has been no development affecting the design and fabrication of mechanical equipment in the last 30 years which offers the advantages of welding. Our progress today, startling in its results as it has been, is only a start. The ultimate goal is still obscure, but it is a safe prediction that it will dominate the mechanical field of the future.



BRING YOUR QUESTIONS TO . . . BOOTH H-20

If you use alloy steel in any form . . . if you are concerned with melting, forging, rolling, heat treating . . . if you are interested in recent developments in alloy cast irons — make a note, now, to visit Booth H-20, National Metal Exposition.

Members of Vanadium's Metallurgical Staff and representatives of the Development and Research Laboratories will be glad to discuss metallurgical problems and to counsel with you in the selection of steels for definite applications. A complete line of Vancoram Ferro-Alloys and some recent Vanadium Steel applications will be on display.

Drop in Booth H-20. Make yourself at home. Ask questions.

VANADIUM CORPORATION OF AMERICA
420 LEXINGTON AVENUE, NEW YORK, N. Y.
Plants at Bridgeville, Pa., and Niagara Falls, N. Y.
Research and Development Laboratories, Bridgeville, Pa.

Vanadium Steels

VANCORAM

FERRO ALLOYS
of vanadium, silicon, chromium, and titanium, produced by the Vanadium Corporation of America, are used by steel makers in the production of high-quality steels.

FOR STRENGTH · TOUGHNESS · DURABILITY

MIDVALE

ALLOY STEEL FORGINGS

Have Several Reasons for Excellence

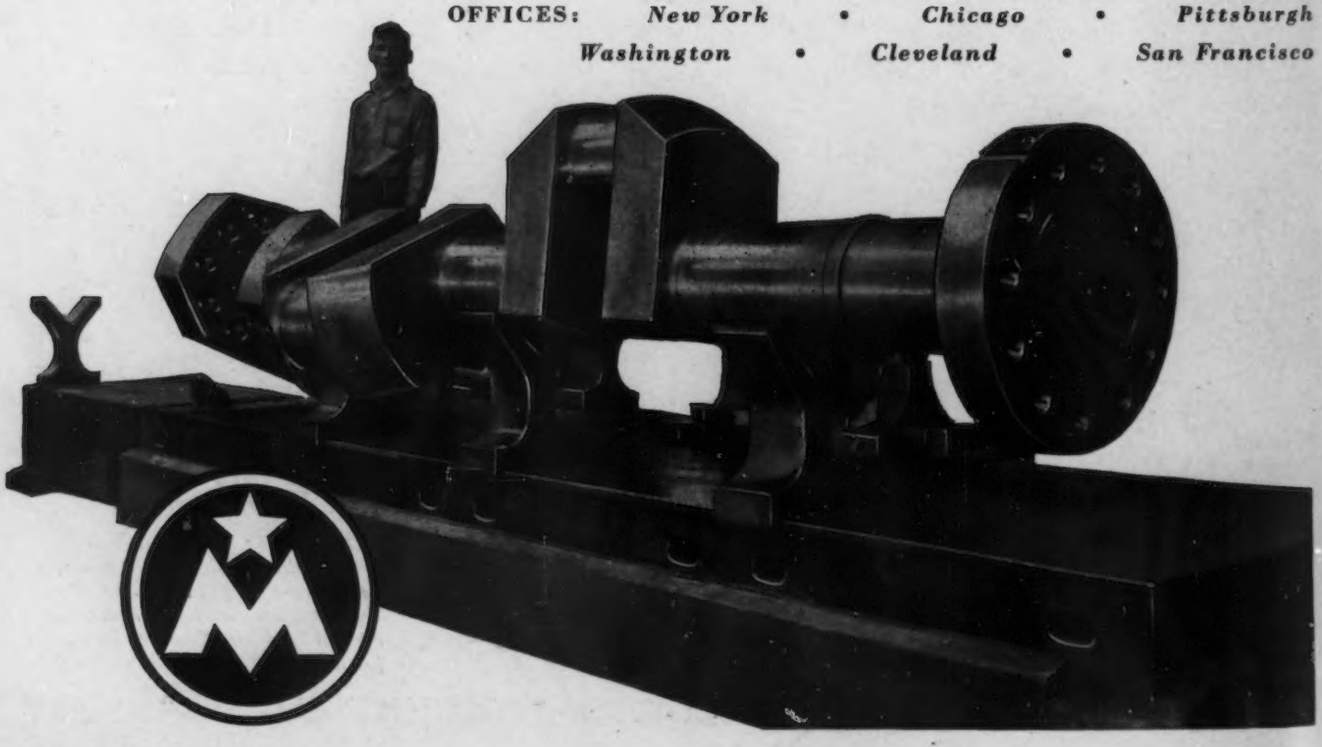
First, they are the product of an integrated plant. From clean, sound metal, through the ingot to the finished forging —every stage is under one central supervision and reverts to one common responsibility.

Further, the properties of every type of steel produced by Midvale have been predetermined in our laboratories and tested in our plant before offered for your use.

For heavy duty, for heat, for whatever requirement, Midvale welcomes the opportunity to prove we produce forgings of dependable excellence.

THE MIDVALE COMPANY · NICETOWN · PHILADELPHIA

OFFICES: *New York* • *Chicago* • *Pittsburgh*
Washington • *Cleveland* • *San Francisco*



NATIONAL ·STEEL·

INDEPENDENT
INTEGRATED
PROGRESSIVE

NATIONAL IS GEARED TO MEET TODAY'S STEEL NEEDS

DOING business with National Steel Corporation is both easy and profitable.

Thoroughly integrated—from coal and ore mines, through transportation and primary facilities, on to finished products of wide variety—National makes diversity and flexibility of production the keynotes in its operating policy.

With decentralized control—administrative, sales and technical heads of each producing unit concentrated *at the mill*—National maintains for its customers that vital, immediate contact with authority which gives speed to important decisions.

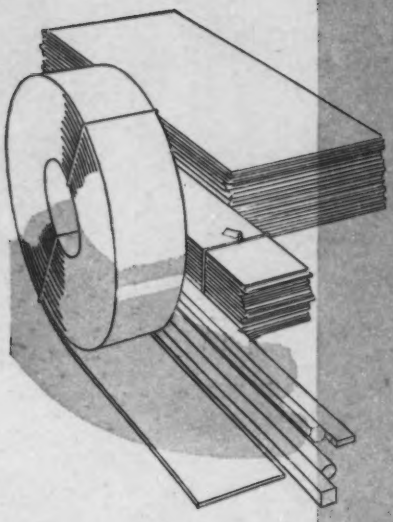
Before the year's close, a completed expansion program will bring National's total ingot capacity to 3,400,000 tons—almost triple that with which the corporation started in 1929, and making National the fifth largest steel producer in the United States.

On the roster of National's customers are firms outstanding in every steel-consuming industry. An order placed with any National unit will demonstrate how this independent, progressive organization of steel men is geared to meet *today's* steel needs.

NATIONAL STEEL CORPORATION

OWNING AND OPERATING—Weirton Steel Company, *Weirton, West Virginia*; Great Lakes Steel Corporation, *Detroit, Michigan*; Hanna Iron Ore Company, *Cleveland, Ohio*; The Hanna Furnace Corporation, *Buffalo, N. Y.* and *Detroit, Michigan*

WEIRTON MAKES IT



WEIRTON PRODUCTS

Pig Iron • Open Hearth Steel Billets-Slabs • Sheet and Tin Bars • Steel Plates-Tie Plates • Angles, Beams, Channels • Hot Rolled Strip Steel • Cold Rolled Strip Steel • Hot Rolled Sheets • Hot Rolled and Annealed Sheets • Cold Rolled Sheets • Long Terne Sheets • Galvanized Sheets • Coke Tin Plate • Charcoal Tin Plate • Copper Bearing Terne Plate • Tin Mill Black Plate • Angle Bars - Rails - Spikes • Bars - Rounds - Squares

WITHIN a decade after its formation in 1905, Weirton Steel Company became the world's largest independent producer of tinplate — a position it still retains.

Before the end of another decade, Weirton built the world's first 48-inch continuous strip mill — a pioneering step which profoundly influenced the whole development of steel manufacture.

Just a little more than a year ago, Weirton again indulged its habit of leadership by reconstructing its continuous tinplate mill to make it one of the most efficient of its type in the world—producing the best quality of tinplate available.

Built by men whose lives have been lived with steel, Weirton is a fully intergrated steel producer—with an annual ingot capacity which ranks it among the country's major companies.

Buiit on the sound foundation of quality and fair dealing, Weirton makes improvement of processes and products its never-ceasing concern.

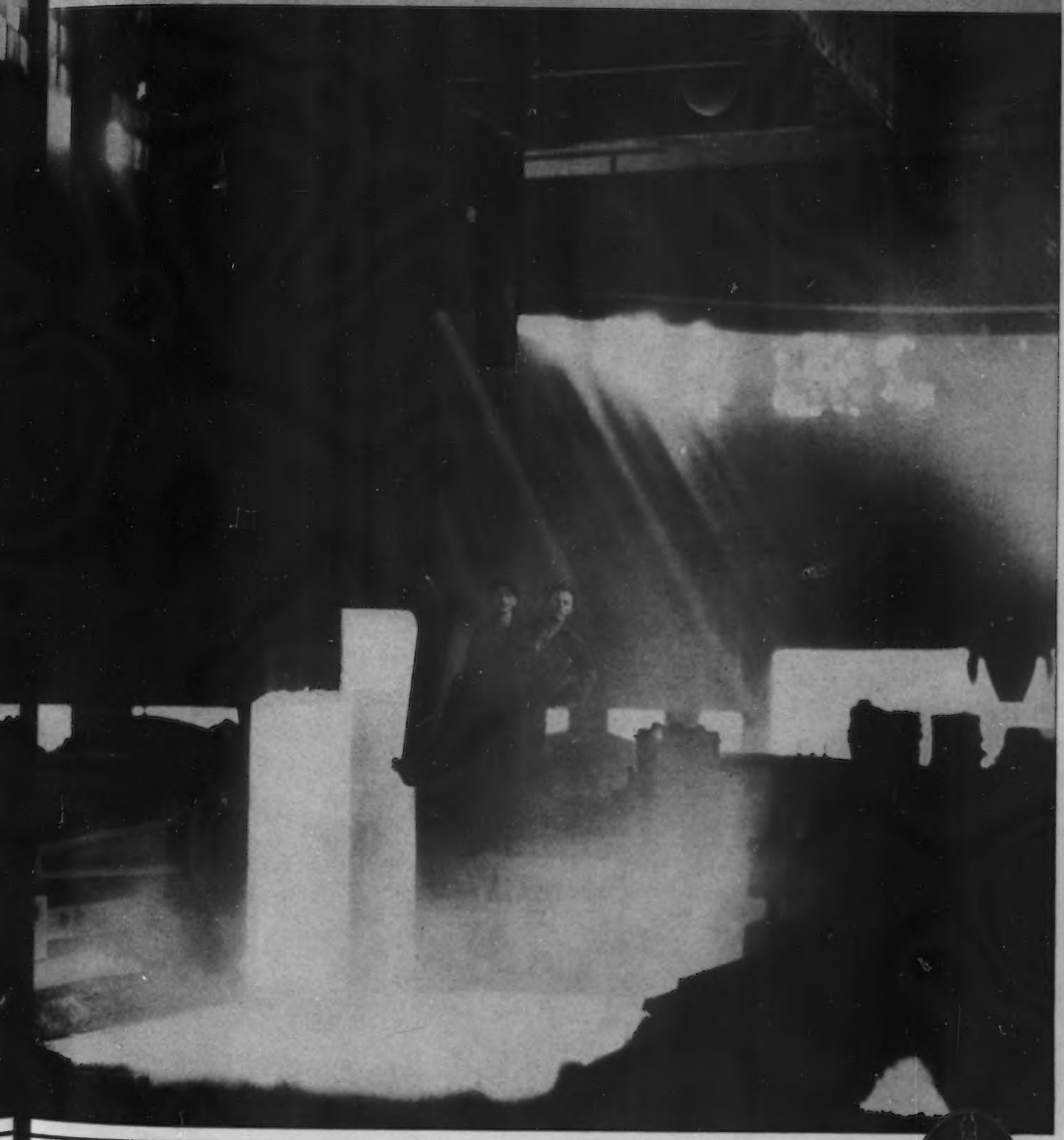
Whenever it is a question of steel, adequate answer will always be found in the wide range of Weirton's facilities and service.

WEIRTON STEEL COMPANY, WEIRTON, WEST VIRGINIA

DISTRICT SALES OFFICES: *Boston*, 1001 Statler Office Bldg.; *Chicago*, 228 North LaSalle Street; *Cincinnati*, 2606 Carew Tower; *Cleveland*, 1217 Leader Bldg.; *Detroit*, 11-210 General Motors Bldg.; *New York*, 500 Fifth Avenue; *Philadelphia*, 1462 Broad St. Station Bldg.; *Pittsburgh*, 2800 Grant Bldg.; *Rochester*, 45 Exchange Street; *San Francisco*, Sharon Bldg.; *Toronto*, General Assurance Bldg., 357 Bay Street

UNIT OF NATIONAL

A HABIT TO SHOW THE WAY



STEEL CORPORATION

NATIONAL STEEL

PRODUCTS OF GREAT LAKES STEEL CORPORATION

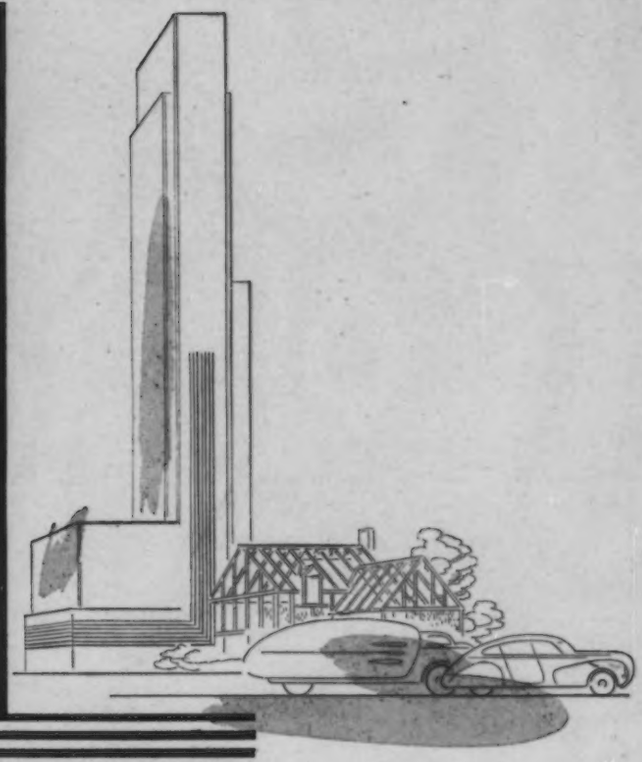
Hot-rolled Strip · Merchant Bars · Forging Bars · Automobile Spring Steel · Miscellaneous Bar Mill Sections · Billets · Sheet Bars · Automobile Sheets · Cold-rolled Sheets · Hot-rolled and Hot-annealed Sheets · Pickled Sheets · MICHIGAN METAL for Vitreous Enameling

GREAT LAKES STEEL CORPORATION, DETROIT, MICHIGAN

DISTRICT OFFICES: *Boston*, 1001 Statler Building; *Chattanooga*, Hamilton Bank Building; *Chicago*, 1026 Builders Building; *Cleveland*, 820 Leader Building; *Dayton*, 1215 Circle Tower; *New York*, 500 Fifth Ave.; *Philadelphia*, 605 Liberty Trust Building; *St. Louis*, E. R. Hensel Co., Cotton Belt Bldg.; *San Francisco*, Sharon Bldg.

UNIT OF NATIONAL STEEL

NATIONAL



GREAT LAKES KEEPS STEP WITH THE TEMPO OF TODAY

IN the spring of 1936, Great Lakes pioneered the world's fastest and largest continuous 4-high mill producing hot- and cold-reduced strip. And the steel rolling out of that mill was the best product of latest advances in steel manufacture.

Today that new Great Lakes mill continues to work in three important ways to the advantage of steel users:

1—The sheet, strip and plate produced are of the finest uniform quality obtainable.

2—Steel in 20 gauge and heavier — and of widths up to and including 90 inches—can be produced faster than ever before was possible.

3—The finished hot- or cold-rolled product is accurately dimensioned to closer tolerances than formerly were permitted.

Born only eight short years ago, Great Lakes Steel Corporation is truly modern—its products squarely in line with the quality demand of today's steel users.

Completely integrated, Great Lakes combines product quality with engineering cooperation and service to a better and more flexible degree than previously has been possible.

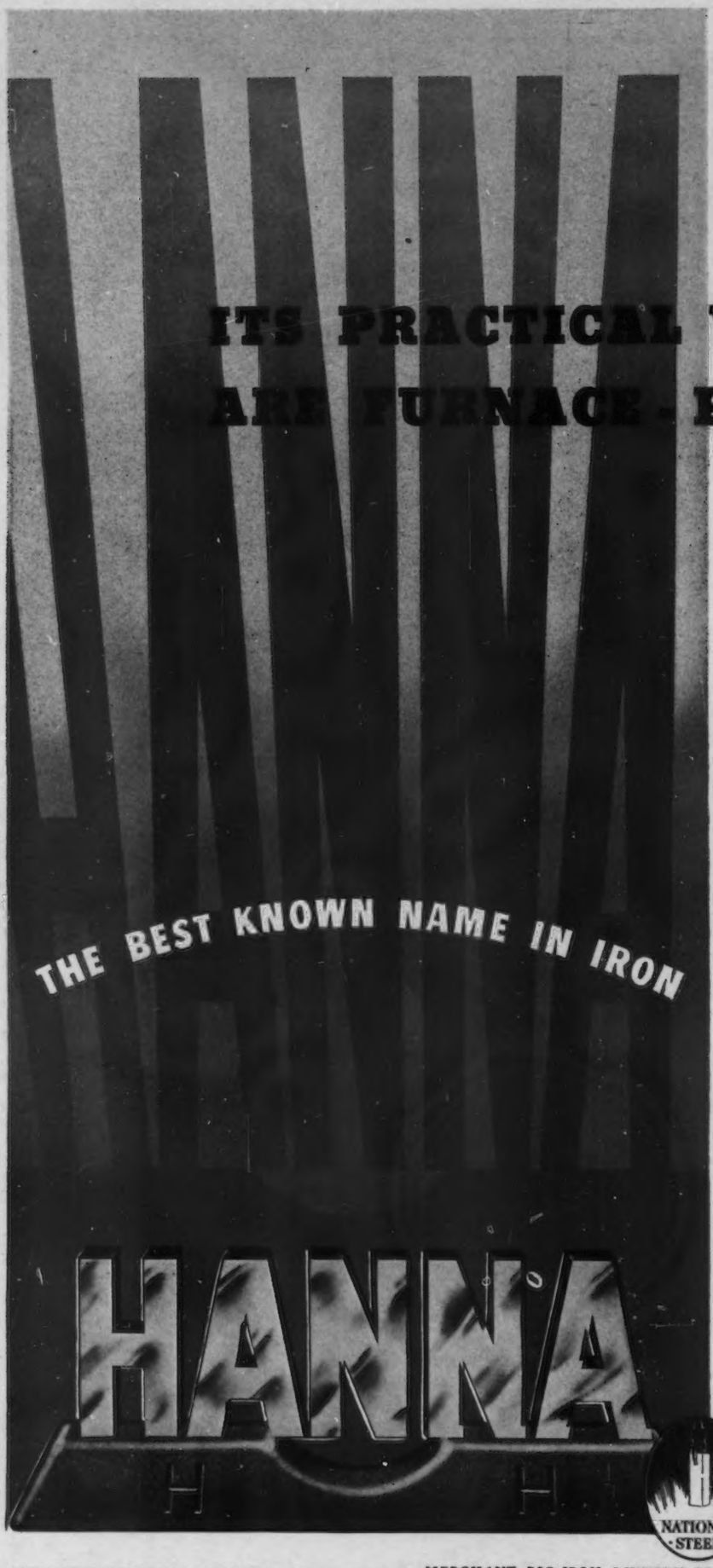
Great Lakes invites your inquiry on any of its products—and will be glad to discuss with you any problem of design or re-design.

Why not make it of steel?

846 Third National Bank Building; *Indianapolis*, *Toronto, Ontario*, General Assurance Building.

HOT ROLLED STRIP . . CARBON STEEL BARS . . PLATE . . SPRING STEEL . . BILLETS . . COLD ROLLED SHEETS . . PICKLED SHEETS . . BLACK SHEETS . . MICHIGAN METAL FOR VITREOUS ENAMELING . . *Widths up to 90"*

STEEL CORPORATION



ITS PRACTICAL VALUES ARE FURNACE - PROVED

FOR seventy years, Hanna merchant pig iron has represented the utmost in dependability. Produced from choice ores of varied metallurgical qualities, it has proved its practical value for the particular job at hand wherever furnace requirements are severe.

Through constant research, and the accumulated experience of men who have been making quality iron for generations, Hanna continues to keep that vital step ahead of changing furnace practice — to remain, as it has since 1867, the best known name in iron.

BRANDS: Buffalo · Detroit · Susquehanna

GRADES: Foundry · Malleable · Silvery
Ferro-Silicon

THE HANNA FURNACE CORPORATION

Buffalo . Detroit . New York
Philadelphia . Boston

MERCHANT PIG IRON DIVISION OF

NATIONAL STEEL CORPORATION

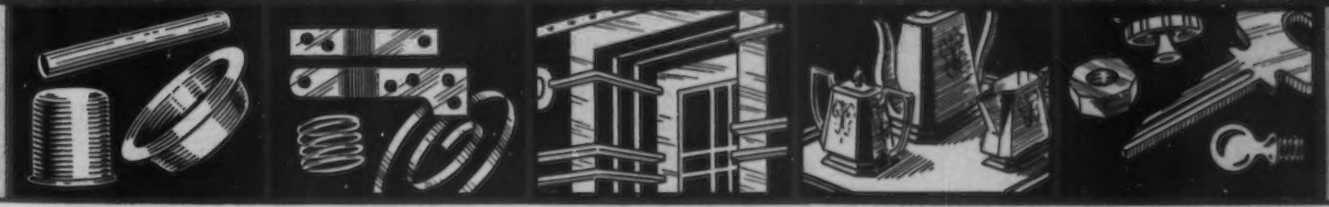
Material IS AS IMPORTANT AS DESIGN

In product development, *material* is just as important as design. Failure to sense this has prevented public acceptance of many a good basic idea. Every detail of a machine or appliance should be as nearly right as expert engineering can make it—and to place performance or appearance at the mercy of doubtful material, to save a few cents here and there, may turn out to be not a gain but a loss—the game may not be worth the candle! Insurance against this is often the use of Seymour Nickel Silver or Phosphor Bronze instead of less dependable alloys.

Absence of any of the following qualities in a produc

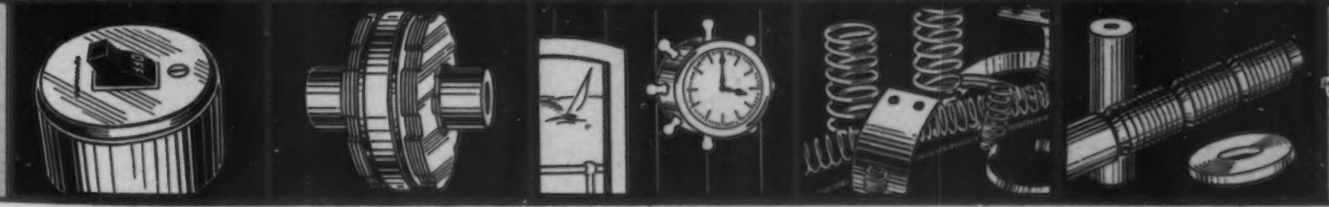
CAN SERIOUSLY HANDICAP ITS CHANCES OF SUCCESS

PREDOMINANT QUALITIES OF SEYMOUR NICKEL SILVER



DUCTILITY | TEMPER | NON-CORRODIBILITY | WHITENESS | MACHINABILITY

PREDOMINANT QUALITIES OF SEYMOUR PHOSPHOR BRONZE



FATIGUE RESISTANCE | FRICTION RESISTANCE | NON-CORRODIBILITY | RESILIENCY | MACHINABILITY

SEYMOUR NICKEL SILVER—An alloy of copper, nickel and zinc. Its even grain makes it ideal for silver plating, and its silvery white color is scarcely perceptible when exposed by wear of plate. Ideal also for other plating, especially chromium, no underplate being necessary. It is capable of a wide range of hardness, from dead soft to a lively spring temper. In its ductile stages, it is superb for deep draws and difficult spinning. When properly leaded, it machines freely. In all its forms, it is practically corrosion proof.

SEYMOUR PHOSPHOR BRONZE—An alloy of copper, tin and phosphorus. Principal characteristics: non-corrodibility, toughness, and extreme fatigue and friction resistance. Subject to a considerable degree of hardness—therefore excellent for springs that must stand long, constant flexure. Practically indifferent to sudden thermal change, will not "arc" when charged or spark appreciably when struck. Very free cutting when leaded. Efficient in electrical instruments, and in all devices used in damp areas. (Test samples of either alloy on request.)

THE SEYMOUR MANUFACTURING COMPANY, 24 FRANKLIN ST., SEYMOUR, CONN

SEYMOUR

NICKEL SILVER—PHOSPHOR BRONZE

"CONTROLLED GRAIN" NICKEL ANODES

COMPLETE CONTROL of every process

from INGOT to FINAL PRODUCT

makes possible the FINISHED EXCELLENCE

UNIFORMITY and QUALITY of

REPRESENTATIVES

New York, N. Y.—Wm. C. Dickey
Pittsburgh, Pa.—McKee-Oliver, Inc.
St. Louis, Mo.—Hubbell & Sharp
San Francisco, Cal.—W. S. Hanford
Boston, Mass.—Edward H. Lloyd
Los Angeles, Calif.
Ducommun Metals & Supply Co.

WORTH

REPRESENTATIVES

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Houston, Texas—The Corbett Corp.
Seattle, Wash.—W. C. Scott, Jr.
Cleveland, Ohio—E. F. Bond
Detroit, Mich.—H. L. Sevin
Montreal & Toronto, Canada
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SHEARED STEEL PLATE

WORTH STEEL COMPANY · CLAYMONT, DEL.

HARDNESS
STRENGTH
DUCTILITY —
in flat wire
indicates
And
CLOSE-UP VIEW OF SAMPLE OF STRIP UNDER TEST FOR ROCKWELL HARDNESS
NO. 1 TEMPER HARD B-90 & OVER
NO. 2 TEMPER HALF HARD B-75 TO 90
NO. 3 TEMPER QUARTER HARD B-60 TO 75
NO. 4 TEMPER SOFT B-50 TO 60
NO. 5 TEMPER ANNEALED UNDER B-50

10th in a series of advertisements designed to help you make a better selection of wire for maximum value per unit of cost

The above Hardness Figures indicate Rockwell B Scale tests.

The relation between temper numbers, description and Rockwell readings are frequently altered to conform to tempers or thicknesses consistent with various existing specifications.

Physical properties of Cold Rolled Strip or Flat Wire are measured by hardness . . . the ability to resist indentation, rather than by breaking load. Strip used for deep drawing or severe bending must be extremely ductile and is indicated by a low Rockwell reading. On the other hand clock spring steel must show a high reading as proof of its tensile strength and stiffness. Proper hardness of Flat Wire is vital to its satisfactory functioning. In the Wickwire Spencer Mills all Strip is thoroughly tested for hardness. From records of constant tests we know the proper Rockwell reading of Flat Wire best for your purpose. Write us and we will gladly advise you.

• •

WICKWIRE SPENCER STEEL COMPANY

New York City, Buffalo, Chicago, Detroit, Worcester. Pacific Coast Headquarters: San Francisco. Warehouses: Los Angeles, Seattle, Portland. Export Sales Dept.: New York

Wickwire Spencer manufactures High and Low Carbon Wires—in various tempers, grades and finishes—for your specific purpose. Hard-Drawn, soft or annealed Basic or Bessemer Wires—Hard-Drawn annealed, or oil-tempered Spring Wire, Chrome Vanadium Spring Wire — Valve Spring — Music — Clip — Pin — Hairpin—Hook and Eye—Broom—Stapling—Bookbinding—Dent Spacer Wire — Reed Wire — Clock — Pinion — Needle-Bar—Screw Stock—Armature Binding—Brush—Card—Florist —Mattress—Shaped—Rope—Welding. Flat Wire and Strip Steel, High or Low Carbon—Hard, annealed or tempered—Clock Spring Steel—Corrosion and Heat Resisting Wires. Consult the Wissco technical man on your wire problems, however large or small.

★The sole specification on many requisitions, "Same as last order," demonstrates customer recognition of the exceptional uniformity of Rustless stainless steel. Maintaining such standards demands the utmost in skill and care.

★Rustless concentrates exclusively on the one job of making finer stainless steel. Rustless bars and wire can prove themselves by performance in *your* shop, as they have in others.

RUSTLESS IRON AND STEEL CORPORATION · BALTIMORE, MARYLAND

Visit Our Booth—A-22—at The National Metals Exposition

RUSTLESS
CORROSION AND HEAT-RESISTING
STAINLESS STEELS

LEE BUILT SPRINGS

OF STAINLESS STEEL BERYLLIUM COPPER OR INCONEL

MAY PROVIDE THE ANSWER TO YOUR SPRING PROBLEM— INVESTIGATE!

Send Us Your Special Folder on STAINLESS STEEL SPRINGS

NAME .....

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LEE-BUILT TRADE MARK SPRINGS

LEE SPRING COMPANY, INC.
30 MAIN ST. BROOKLYN, N.Y.

USE THIS COUPON FOR YOUR COPY →→→→→→→→→

INCREASE YOUR PROFITS WITH J&L STEEL

VISIT THE J&L EXHIBIT

J&L PRODUCTS: HOT ROLLED BARS, PLATES AND SHAPES · LIGHTWEIGHT CHANNELS · JUNIOR BEAMS · BARS FOR CONCRETE REINFORCEMENT · RAILROAD SPIKES AND TIE PLATES · STEEL PILING · HOT AND COLD ROLLED STRIP AND SHEETS · FLAT GALVANIZED SHEETS

Booth E-32

NATIONAL METAL SHOW AT ATLANTIC CITY OCTOBER 18-22

See an interesting and informative display of J&L Steel Products

To get helpful information on the right quality of steel for your applications . . . to improve your production and better the quality of your products . . . visit the J&L Exhibit. Attending J&L Metallurgists will be available to consult with you on your more important steel problems and give you helpful suggestions on the application of J&L Steel in your manufacturing operations.

On display will be highly interesting and informative exhibits covering a wide variety of parts made of J&L Jalcase Steel, J&L *Improved* Bessemer Screw Stock, J&L Cold Finished Steel, J&L Forging Steel, J&L Cold Heading Wire, J&L Standard Spring Wire, and containers and closures made of J&L Coke Tin Plate.

These parts are of both intricate and unusual design and give evidence of the advantages of using J&L Steel. Of particular interest will be the display featuring finished parts formed of strip and sheet products rolled on the new J&L 96-inch Continuous Strip Mill.

Visit the J&L Exhibit . . . Booth E-32 . . . and learn how J&L Steel speeds up production . . . cuts down costs and helps to bring you greater sales and profits. Standardize on J&L Steel for all your needs.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

GALVANIZED ROOFING AND SIDING · COLD FINISHED BARS AND SHAPES · WIRE RODS AND WIRE PRODUCTS · SEAMLESS & WELDED TUBULAR PRODUCTS · TIN PLATE, BLACK SHEETS AND MANUFACTURING TERNES · FABRICATED STRUCTURAL WORK · COKE BY-PRODUCTS

Trade Mark Reg.

INGACLAD

STAINLESS-CLAD STEEL

"A Borg-Warner Product"

Stainless ON THE SIDE THAT IS USED-

Bonded to STEEL BACKING

A few well-known users of IngAclad

American Chemical Paint Co.
American Cyanamid Co.
American La France & Foamite Co.
Armour & Co.
C. O. Bartlett & Snow Co.
Campbell Soup Co.
Carnation Milk Co.
Coppes, Inc.
Corn Products Refining Co.
Corning Glass Works
Dow Chemical Co.
E. I. Du Pont de Nemours Co.
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Gold Dust Corp.
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Jeffrey Mfg. Co.
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Libby, McNeill & Libby
Eli Lilly & Co.
Link-Belt Co.
Liquid Carbonic Co.
Monsanto Chemical Co.
Morton Salt Co.
Petrolagar Corp.
Postum Cereal Co.
Procter & Gamble Co.
Standard Brands Inc.
Stevens Metal Products Co.
Swift & Co.
United States Potash Co.
Walgreen Co.
Welsbach Co.
Weyerhaeuser Timber Co.

Stainless Protection at much Lower Cost!

IngAclad greatly widens the possibilities for the use of stainless steel. By reducing material costs approximately 50%, marked economies are offered to the Chemical, Food and other process industries. The secret of the inseparable bond is in the Ingersoll Ingot Patented Process. The molten metals are bonded inseparably, so that sheets and plates of IngAclad may be handled through all fabricating processes without danger of separation. It may be drawn, formed, beaded, welded, soldered and fabricated by the same equipment used with mild carbon steel.

INGERSOLL STEEL & DISC DIVISION

Borg-Warner Corporation

Specialists in High Carbon, Alloy and High Speed Steel and Stainless-Clad Sheets and Plates

Plants: **Chicago, Ill., and New Castle, Ind.** **310 South Michigan Ave., Chicago, Illinois**

Representatives: H. Boker & Co., Inc., 101-103 Duane St., New York, N. Y.
J. R. Kindig, Red Rock Bldg., Atlanta, Ga.
Clark P. Schumacher, 240 S. Boyle Ave., St. Louis, Mo.
The Cameron & Barkley Co., Tampa, Fla.
Equitable Equipment Co., 410 Camp St., New Orleans, La.
R. E. Chase & Co., Tacoma Bldg., Tacoma, Wash.
Bruce Donald, 164 Dufferin Ave., Brantford, Ontario

This Art of Making Brass...

The making of brass has long been regarded as an art. But skillful craftsmanship alone cannot cope with the manifold copper-alloy requirements which Industry demands. Nor can this Company's century of practical experience be the complete solution of today's varied needs. Yet, this combination of skill and knowledge, when supplemented by strict TECHNICAL CONTROL of all materials and every step of production, has led the way in producing Anaconda Alloys of higher strength, greater workability, superior corrosion resistance, and an unusual degree of uniformity and dependability.

THE AMERICAN BRASS COMPANY

GENERAL OFFICES: WATERBURY, CONNECTICUT. • OFFICES AND AGENCIES IN PRINCIPAL CITIES

ANACONDA
from mine to consumer

Anaconda Copper & Copper Alloys

EVERDUR* • TOBIN* BRONZE • PHOSPHOR BRONZE •

HIGH PURITY IS MAINTAINED IN ALL ANACONDA METALS

In the production of Anaconda Copper and Brass, technical control starts long before the metals reach the casting shop. The purity of Anaconda Copper and Zinc is maintained at 99.9+%. Both are electrolytically refined by a single organization responsible for every process of mining, smelting, refining and manufacturing. Other alloying elements are also of the highest quality obtainable. Detrimental impurities are thereby eliminated and the composition is under absolute control. Routine analyses of test samples and frequent inspection during fabricating operations are further assurances of the consistent performance of the finished product.

WIRE AND RODS—Copper, and a wide range of copper-alloy wire and rods are available to suit practically every requirement. Wire from .002" diameter and larger is furnished in tempers ranging from full annealed to extra spring (depending on the composition) and is supplied in coils, on spools to specific weights, or cut to required lengths. Rods for general fabrication and engineering purposes up to 3½" diameter, and larger, depending on composition and length, are produced by extrusion, hot or cold rolling and drawing, or a combination of these operations. Free cutting copper, brass, bronze, nickel silver and Everdur rods are supplied in long mill lengths for screw machine use. Both wire and rods are produced in round, square, hexagon, octagon, and other conventional and special shapes.

SHEETS AND PLATES—in a wide range of alloys, hot rolled or cold rolled, can be furnished in various tempers and in thicknesses of .003" and heavier. Hot rolled sheets are available in widths up to 132", depending on the alloy and gauge requirements. Special care is taken to produce sheets and plates with commercially perfect surfaces free from waves, buckles or other defects.

Casting Brass Slabs which are Rolled into Sheets.

Above: Extruding Round Brass Rods.

Below: Hot Rolling Wide Copper Shee

Anaconda Copper &

Piercing Copper Billets by the Mannesmann Process.

Above: Multiple Slitting of Brass Strip.

Below: Polishing Sheet Copper.

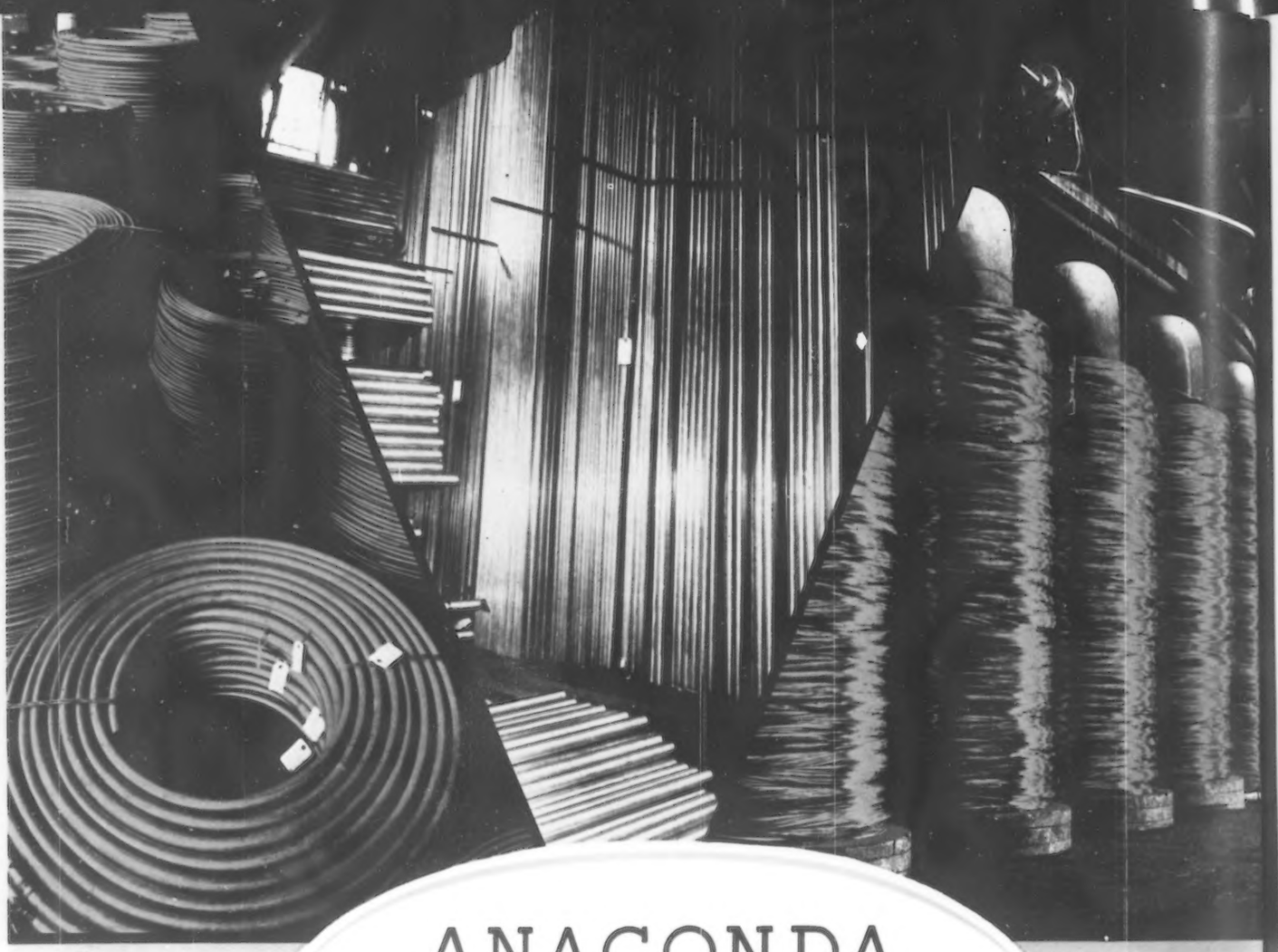
SEAMLESS PIPE AND TUBES—The American Brass Company manufactures copper and copper-alloy seamless pipe and tubes by all the usual methods; cast shell, cup drawn, Mannesmann, and the "extruded, rolled and drawn" process. The method of manufacture depends on the composition, size, shape, wall thickness, and the intended service. Round seamless tubes are produced in sizes from .020" O.D. to 26" I.D. and in various wall thicknesses for manufacturing and engineering purposes. Square, hexagon, octagon and irregular shaped tubes are supplied in a variety of sizes and alloys. Deoxidized copper tubes for plumbing, heating, and carrying lines, in various gauges, are furnished hard drawn in straight lengths from $\frac{1}{8}$" to 12" nominal sizes. Soft tubes up to $1\frac{1}{4}$" are supplied in 30, 45 and 60-foot coils. Solder type and flared tube fittings for connecting these tubes are also available. Anaconda Copper and Brass Pipe is manufactured in standard pipe sizes from $\frac{1}{8}$" to 12", and in two wall thicknesses.

METAL FINISHING—In the plants of The American Brass Company, special finishing equipment is employed and every precaution is taken to supply Anaconda Copper, Brass, Bronze, Nickel Silver and Special Alloys that exactly meet the customer's fabricating requirements. Sheets, rolls and strips are accurately finished to width, length and gauge, and either slit, sheared or sawed to close tolerances. Special spring tempers; resquared metal; unfinished metal in coils for rerolling purposes; slit metal in rolls (edgewise straightened and recoiled, or with rolled edges); and leaded sheets are also available. Metal can be furnished with special finishes: Polished, or prepared suitable for polishing; lacquered; scratch brush finished; embossed; furbished; dry rolled for etching or engraving; also tinned, nickel plated, chrome plated, lead coated, etc. A specialty is made of polishing strips and sheets. Inquiries regarding unusual metal problems or special finishes will be given prompt attention.

* Trademarks Registered in U. S. Patent Office

Copper Alloys

ANACONDA
from mine to consumer



ANACONDA

A Dependable Source of Supply plus a Complete Service

The American Brass Company offers a complete range of Copper and Copper Alloys in the form of sheets, strips, plates, wire, rods, bars, seamless tubes and special shapes • These Anaconda Metals are furnished to suit YOUR needs—in composition, temper, gauge, size, finish and working qualities • To facilitate deliveries, seven manufacturing plants and adequately stocked warehouses are supplemented by distributors throughout the country • When special metal problems arise, remember that practical Service Engineers and an experienced Technical Department are at your service.

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY

GENERAL OFFICES: WATERBURY, CONNECTICUT. • OFFICES AND AGENCIES IN PRINCIPAL CITIES

Anaconda Copper & Copper Alloys

• WELDING RODS • DIE PRESSED PARTS

OLD DOGS—NEW TRICKS

Two old timers, Monel and Nickel, will exhibit new qualities in new products at Fall Conventions

● You've seen Monel* and Nickel at many past conventions, no doubt. You know these old timers are tough, rust proof, corrosion resistant metals. This year be sure to see them again: For Monel and Nickel will introduce to you *new products* for uses you'd never have thought possible.

Interesting and mighty important functions are performed with Monel and Nickel alloys these days. Visit the Inco booth at any of the above shows and see new products like these:

Heat-Treated Machined Parts: machined parts with strength and hardness comparable to heat-treated alloy steels—made from "K" Monel and "Z" Nickel machined, then heat-treated.

Castings Stronger and Tougher than medium carbon steel castings: made from Monel and "H" Monel.

Non-Seizing Castings: exceptionally hard castings with excellent non-seizing properties made from "S" Monel.

FALL SHOWS

OIL WORLD EXPOSITION
October 11th to 16th
Petroleum Bldg., Houston, Texas

19th NATIONAL METAL EXPOSITION
October 18th to 22nd
Atlantic City Auditorium, Atlantic City, N. J.

16th EXPOSITION OF CHEMICAL INDUSTRIES
December 6th to 11th
Grand Central Palace, New York, N. Y.

Free Machining Rods of "R" Monel for quantity production of intricate parts in automatic screw machines.

Unbreakable Combustion Boats: used in making carbon analyses—made with carbon-free Nickel.

We'll be glad to welcome you to our booth at any of the above Conventions—glad to give you the latest dope on Monel and Nickel. And if you can't make the convention, but want the dope, drop a line to:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York, N. Y.**

MONEL

*Monel is a registered trade-mark applied to an alloy containing approximately two-thirds Nickel and one-third copper. This alloy is mined, smelted, refined, rolled and marketed solely by International Nickel.

CRUCIBLE HOT

MADE BY *Craftsmen*

Head hammersman (at right) with one of his crew, "cogging" a hot billet.

In Crucible employ 22 years. His father before him was a Crucible craftsman and his two brothers are in charge of Crucible hammers.

CRUCIBLE STEEL COMPANY OF AMERICA

World's Largest Producers of High Speed, Tool and Special Purpose Steels

GENERAL OFFICES: CHRYSLER BLDG., NEW YORK

T WORK STEELS
...s FOR *Craftsmen*

To have and to hold the world's largest sales of high speed, tool and special purpose steels, as Crucible has for 37 years, is more than a tribute to craftsmen from craftsmen. It is the logical result of Crucible's key policy of developing and producing specialized steels for specific purposes—a policy of particular benefit to users of Hot Work Steels.

Beginning with Peerless "A," the pioneer tungsten type in the field, Crucible has developed a comprehensive range of Hot Work Steels for particular types of service—made them quickly available anywhere from established stocks at 27 Crucible branch offices and warehouses—and guided users in the proper choice for specific applications through our expert service men and metallurgists.

Listed elsewhere in this advertisement, under the several classifications, are Crucible Hot Work Steels, known the world over to craftsmen toolmakers. In the making of such steels, craftsmanship is an indispensable ingredient.

...fficult hot forging job at our Atha Works. Photo shows punch, die and product (Crusca Drill ... unfinished and finished. Our own production serves here as your laboratory experiment.

HOT WORK STEELS

High Tungsten Steels

Rex "AA," Rex "A," Peerless "A," Peerless "B" Peerless "C," Peerless "D," Halcomb Hot Work, L.L.C.T., L.C.T.

These steels have splendid red hardness properties, excellent resistance to heat checking and high resistance to abrasive wear. Recommended for applications demanding *maximum life* where die-design is such that transverse stresses are not great.

Intermediate Tungsten Steel

Atha Pneu

Possesses excellent shock resistance qualities and is recommended for service where severe pounding at low temperatures is encountered.

Straight Chromium Steel

Crescent Hot Work 2

Recommended where greater transverse strength is needed than can be obtained in high tungsten steels, and extremely long runs are not required.

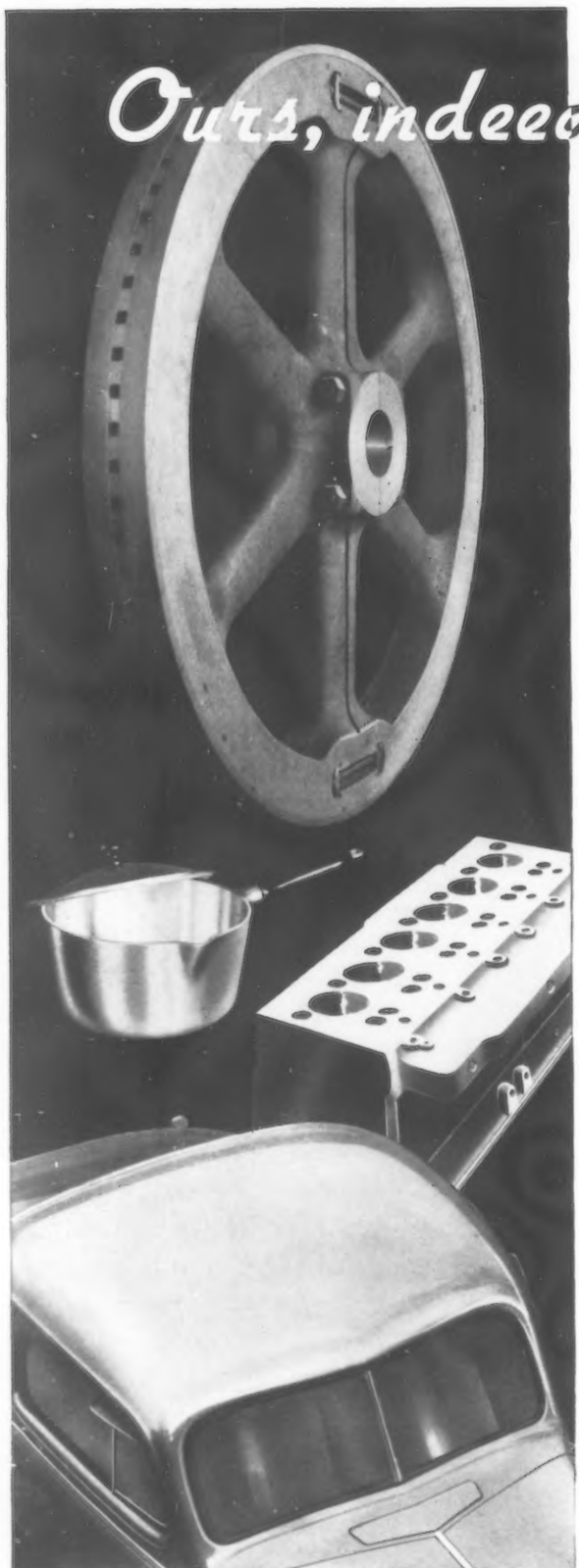
Chromium Steels with other Alloys

La Belle 89, La Belle Special Hot Die, La Belle Cromonic, Pyro Die, Halcomb 218

These steels combine high transverse strength with good red hardness properties and excellent resistance to heat checking. Used for a wide variety of applications, particularly for highly stressed parts.

For further information

Send for TOOL STEEL CATALOG and DATA BOOK



Ours, indeed, is the AGE *of* ALLOYS

No longer is it the "Age of Steel"! For today even steels are fast joining the "alloy family" and gaining much in strength, machinability and endurance through the scientific inclusion of "alloying agents" during production.

Titanium plays a leading role in this new conception of metals. Not only in steels and the ferrous group, but in the great field of non-ferrous metals, Titanium alloys are paving the way to better products.

Titanium was first introduced commercially by TAMCO in 1906 in the form of TAM *Original* FCT (Ferro Carbon-Titanium), a cleansing and deoxidizing agent. Since then new developments have revealed the effectiveness of Titanium Compounds in improving quality and obtaining desired physical properties . . . Its stabilizing influence on carbon—its ability to age-harden copper—its prevention of intercrystalline corrosion in stainless steels—its "grain refining" effect—these and many other achievements of Titanium mark it as one of modern metallurgy's most useful servants.

Why not have a TAM Engineer call and outline the potential usefulness of Titanium to your output? TAM Metallurgical Alloys include TAM *Original* High Carbon FCT No. 78, TAM Medium Carbon FCT No. 35, TAM Low Carbon Ferro-Titanium (both 25% Ti and 40% Ti), TAM Foundry Ferro-Titanium, TAM Webbite (Alumino Titanium) and many others.

★ **Come to the TAMCO Booth F-76 at the National Metals Exposition in Atlantic City. TAM Engineers will be glad to "talk things over".**

TAM
ZIRCONIUM-TITANIUM PRODUCTS

THE TITANIUM ALLOY MANUFACTURING CO.

GENERAL OFFICES AND WORKS: NIAGARA FALLS, N. Y., U. S. A.
EXECUTIVE OFFICES: 111 BROADWAY, NEW YORK CITY

Representatives for the Pacific Coast: BALFOUR, GUTHRIE & CO., San Francisco, Los Angeles, Portland, Seattle, Tacoma . . . . *Representatives for Canada:* RAILWAY & POWER ENG. CORP., LTD., Toronto, Montreal, Hamilton, Winnipeg, Vancouver, Sydney . . . *Representatives for Europe:* T. ROWLANDS & CO., LTD., 23-27, Broomhall St., Sheffield, England

TAMCO

Better performance thru better metals

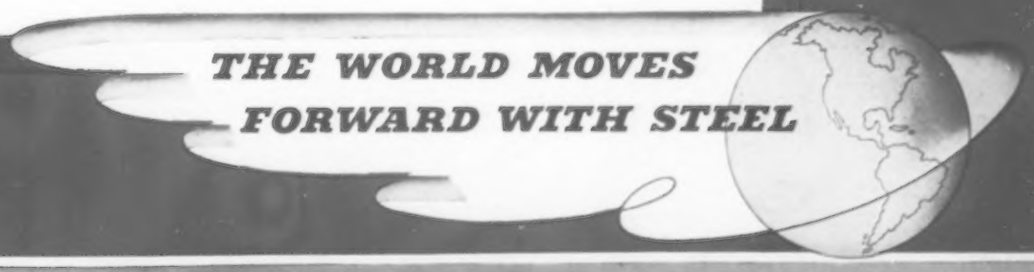
FULL SPEED AHEAD!

WHAT are the problems which confront industry today: foreign competition . . . the ever-increasing burden of taxation . . . the never-ceasing urge for more abundant living . . . the economic cry for increased production at lower costs? Yes. These and countless others which clamor equally for solution.

History supports our confidence that American industry will solve these problems as it has solved countless others before . . . by going full-speed ahead, by fearlessly abandoning old ways for new, by adopting new standards, new formulae, and by placing its reliance on tireless research, on science and invention.

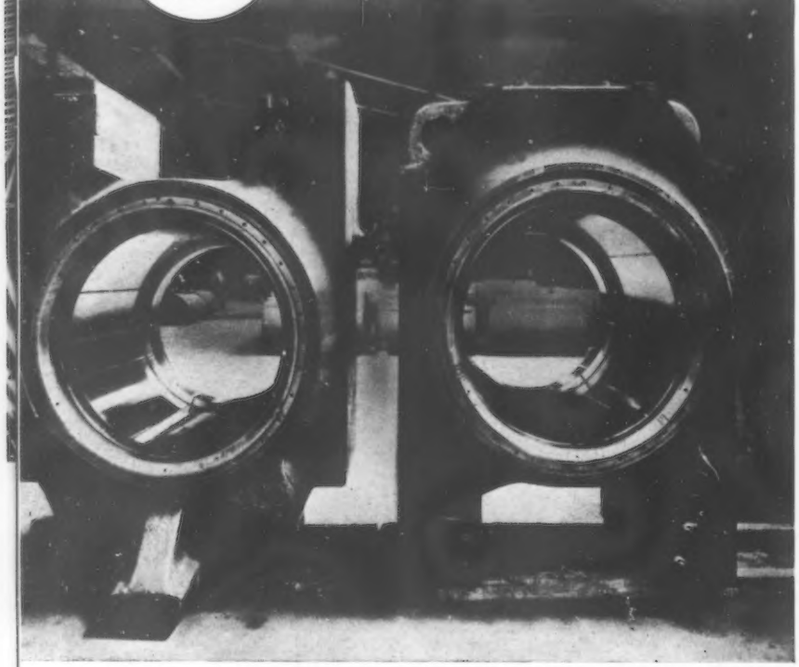
Nowhere is this more noticeable than in the metal trades. The story of progress in the industrial arts is largely the story of improvements in steel. Out of the steel laboratory has come the means needed by designer, engineer, builder to fashion new products . . . to improve machinery . . . to speed transportation . . . to add to the comfort and well-being of everyone. For it is *steels* today, not just steel. Steels of a thousand properties. Steels with the peculiar qualities needed for any part . . . for any task.

Within the Subsidiaries of United States Steel more than 1700 technical experts—chemists, metallurgists, engineers—working in our 89 laboratories, continue their never-ceasing search for better steels to make industry's job easier and more profitable. From their endeavors have come the steels featured on the following pages . . . will come countless others, to keep pace with the forward march of industry. These men, we like to think, are your true partners; they face new horizons with confidence.



UNITED STATES STEEL

For every job that metal can do . . . there's a steel best suited to do it



WORLD'S LARGEST ROLLNECK BEARING is made of U·S·S Carilloy Alloy Steel as specified and carries a radial load of 5,247,000 lb. It is obvious that nothing but the finest, most dependable alloy steel could be used. U·S·S Carilloy Alloy Steels offer maximum quality with utmost uniformity. Back of the name are Carnegie-Illinois' special mill facilities—craftsmen trained specifically for alloy production—exact metallurgical control.

30 CUBIC YARDS AT ONE GULP! U·S·S Man-Ten all-welded construction gives this heavy duty dipper the strength and abrasion resistance to keep it on the job in this grueling service. The thousands of pounds of weight saved by this better, stronger steel have been converted into working capacity. Investigate what U·S·S High Tensile Steels can do for you.

FABRICATION PRESENTS NO DIFFICULTIES WITH U·S·S HIGH TENSILE STEELS You are not asked to pioneer with U·S·S Cor-Ten, Man-Ten and Stainless. The experimental period is over. Practically every question involving shop methods has already been answered. With these steels industry has opened a whole new field for equipment design, found the way to reduce dead weight and cut down corrosion losses.

ACID DRUMS OF U·S·S STAINLESS, chosen because of their immunity to most corrosive chemicals, cut shipping costs, provide easier handling, reduce storage space, eliminate breakage. Wherever strength, lightness, immunity to destructive wear, prevention of contamination and permanence of finish are wanted, no metal can surpass U·S·S Stainless Steel.

HE'S WORKING U·S·S CONTROLLED STEEL, but what the picture can't show is the saving which is being effected through the use of a comparatively low-cost steel in which all quality factors are definitely predetermined—steel that will perform uniformly under forging, forming, heat-treating and machining, each shipment acting precisely like the last.

FOR FLUID HANDLING—U·S·S STAINLESS tubes, as brilliant inside as out, keep products clean, reduce pressure drops. Seamless tubing of U·S·S Stainless Steel made by National Tube Company is performing a service unmatched by any other metal. From the Subsidiaries of United States Steel Corporation comes U·S·S Stainless in any wanted form.

A-R STEEL CUTS ABRASIVE WEAR Wherever earth, sand, gravel, coal, waste, etc. flow over, through or against equipment, that is the place for U·S·S Abrasion Resisting Steel, a relatively new alloy, which will in many applications last longer than higher-cost steels. Manufactured by Carnegie-Illinois, A-R Steel is explained in a special bulletin which will be sent on request.

THESE SPECIAL PURPOSE STEELS ARE DOING THEIR PART TO SPEED UP INDUSTRY

EACH FAMILY of steels described below owes its existence to a definite need and reveals steel's ability to meet unusual requirements. Each has definitely established its worth in countless applications. These few examples serve to emphasize the readiness of United States Steel Corporation Subsidiaries to furnish whatever steel your job requires and in whatever form you need it—plates, sheets, bars, tubing, wire, etc.

U·S·S CARILLOY: This new name, identifying controlled alloy steels produced by Carnegie-Illinois Steel Corporation, means quality alloy steels made to your specifications. Back of the name are special mill facilities—steel craftsmen trained specifically for alloy steel production—exact metallurgical control. Keep this name in mind. It is your assurance of quality, your guarantee of the dependable performance of your product in service.

U·S·S CONTROLLED STEELS are steels for forging, forming, heat-treating and machining in which all quality factors can be definitely predetermined . . . steels in which the physical properties are consistently uniform. Scientific metallurgical control eliminates those "mysterious differences" which make it so difficult to obtain results with ordinary steels.

U·S·S A-R STEEL There is no better low-cost solution to abrasion problems than U·S·S Abrasion-Resisting Steel. Even though initial cost is comparatively low, it has stood up better in some installations than 11/14% manganese steel and other high priced materials. More than 68% of the present sales volume is repeat business—proof that A-R Steel is doing a real job where abrasive conditions are severe.

U·S·S HIGH TENSILE STEEL

Broadly speaking, U·S·S COR-TEN and MAN-TEN can be applied to effect operating economies, to increase strength or to prolong life, in practically every kind of mobile equipment. What these pioneer High Tensile Steels have done to modernize transportation equipment, through weight reduction, is already a matter of record.

U·S·S STAINLESS STEEL

No other metal can even approach stainless steel in strength and permanence. It makes possible the use of lighter sections and eliminates needless pounds and needless cost. By specifying U·S·S Stainless Steel you can cut depreciation costs, practically eliminate corrosion.

VISIT OUR EXHIBIT AT THE METALS SHOW

A PROBLEM IN STEEL?

Put it up to U·S·S!

SINCE steel became steels, with a thousand variations and properties, the knowledge of its suitability to countless applications has become highly specialized.

What makes this knowledge particularly important is the savings it oftentimes effects in applications. Even though the steel you are using now on a certain job may be performing satisfactorily, there may be a less expensive steel which would serve as well.

Finding ways for our customers to save in steel, finding a better steel for the job, solving problems of cutting, shaping, welding and fabrication, is a task we gladly take upon ourselves. It is our conception of service, and through it we have made many friends.

So we say to you as we say to all industries—Have you a problem in steel? Put it up to us. Send us your blueprints. Let us come into your shop if need be and work with your own specialists to find a solution.

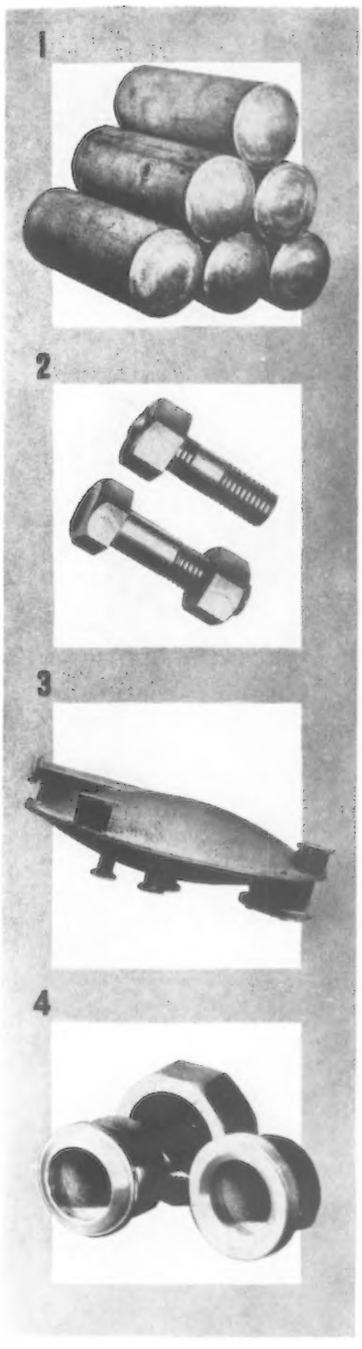
AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

United States Steel Products Company, New York, *Export Distributors*
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

UNITED STATES STEEL

This Versatile Metal May Solve Your Problem

HERCULOY*



Herculoy is the name of a group of improved silicon-copper alloys as manufactured by Revere Copper and Brass Incorporated. These alloys combine the strength of steel with the corrosion resistance of copper. Herculoy is made in four principal compositions and can be cut, spun, stamped, drawn, hot and cold forged, welded or otherwise manipulated by standard fabricating processes. It is non-magnetic, has low thermal and electrical conductivity, has a pleasing gold color and is capable of taking a handsome finish. Herculoy is available in the form of hot rolled, cold rolled or cold rolled and annealed sheets, plates, rolls and strips; hot rolled and cold drawn rods, bars and shafting; tubes; welding rods; and ingots for sand casting.

New HERCULOY BULLETIN: Properties and characteristic applications of Herculoy are described and illustrated in a new 64-page Revere Bulletin now ready for distribution. Copy sent free on request. Please address your inquiry to our Executive Offices, 230 Park Avenue, New York City.

1. Herculoy cylindrical fuel tanks for U.S. Coast Guard vessels.

2. Herculoy heavy duty nuts and bolts.

3. Herculoy benzol recovery tank. Illustration shows top and bottom sections.

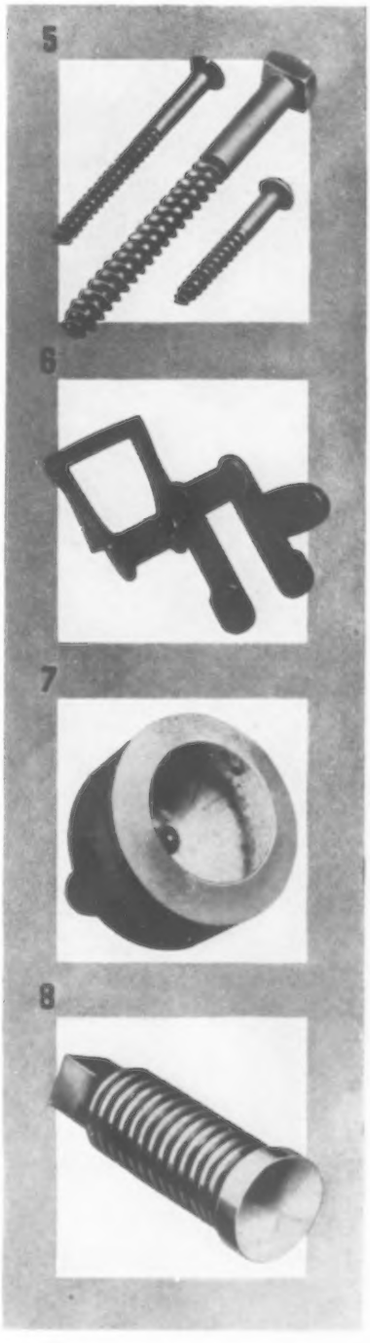
4. Herculoy pipe union seats.

5. Herculoy lag screws for mine timbering.

6. Herculoy conveyor chain link.

7. Herculoy centrifugal extractor basket.

8. Herculoy packing gun cylinder for steam plant unit.



*U. S. Patents No. 1,868,679; 1,924,581; 2,002,460; 2,009,977 and 2,035,414. Licensed under U. S. Patents No. 1,539,260; 1,933,390; 1,936,397 and others.

Revere Copper *and* Brass

INCORPORATED

FOUNDED BY PAUL REVERE

1801

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK CITY • MILLS: BALTIMORE, MD. • TAUNTON, MASS. NEW BEDFORD, MASS. • ROME, N. Y. • DETROIT, MICH. • CHICAGO, ILL. • SALES OFFICES IN PRINCIPAL CITIES

Drop Forgings Die Making Machinery

COMMERCIAL DROP FORGINGS · BOARD DROP HAMMERS and DIE MAKING MACHINERY

BILLINGS

THE BILLINGS & SPENCER CO. HARTFORD, CONNECTICUT, U. S. A.

Three quarters of a Century of forging experience - - -

Billings—the standard by which Drop Forgings are judged. Quantities, large or small—from a few ounces to hundreds of pounds. Controlled—Grain Size Steel made to our specifications, proper control of flow lines plus modern metallurgical knowledge and engineering skill made Billings Drop Forgings the standard for faultless Forgings.

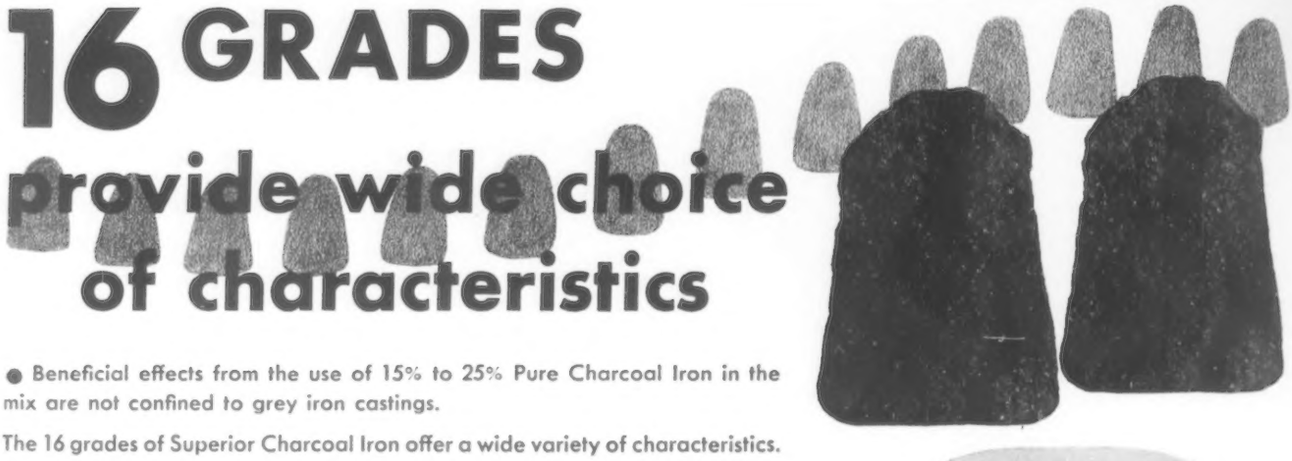
Manufacturers in varied lines of industry use Billings Board Drop Hammers and Die Making Machining—dependable and profitable.

The service of our Engineering Dept. is Gratis.

Literature gladly sent. Write Dept. "CF."

Blanking and Trimming Die Milling Machine

16 GRADES provide wide choice of characteristics



● Beneficial effects from the use of 15% to 25% Pure Charcoal Iron in the mix are not confined to grey iron castings.

The 16 grades of Superior Charcoal Iron offer a wide variety of characteristics. Some grades are useful in controlling depth and hardness of chill. Others improve the quality and density of white iron. Others are useful with rolled scrap in air furnace mixtures to cast hot rolls. Still others will benefit malleable mixtures of various kinds.

All produce better castings — and reduce scrap by eliminating causes for rejection. Scrap losses have been reduced by as much as 50%. Slight increase in cost of raw materials is more than offset by this saving.

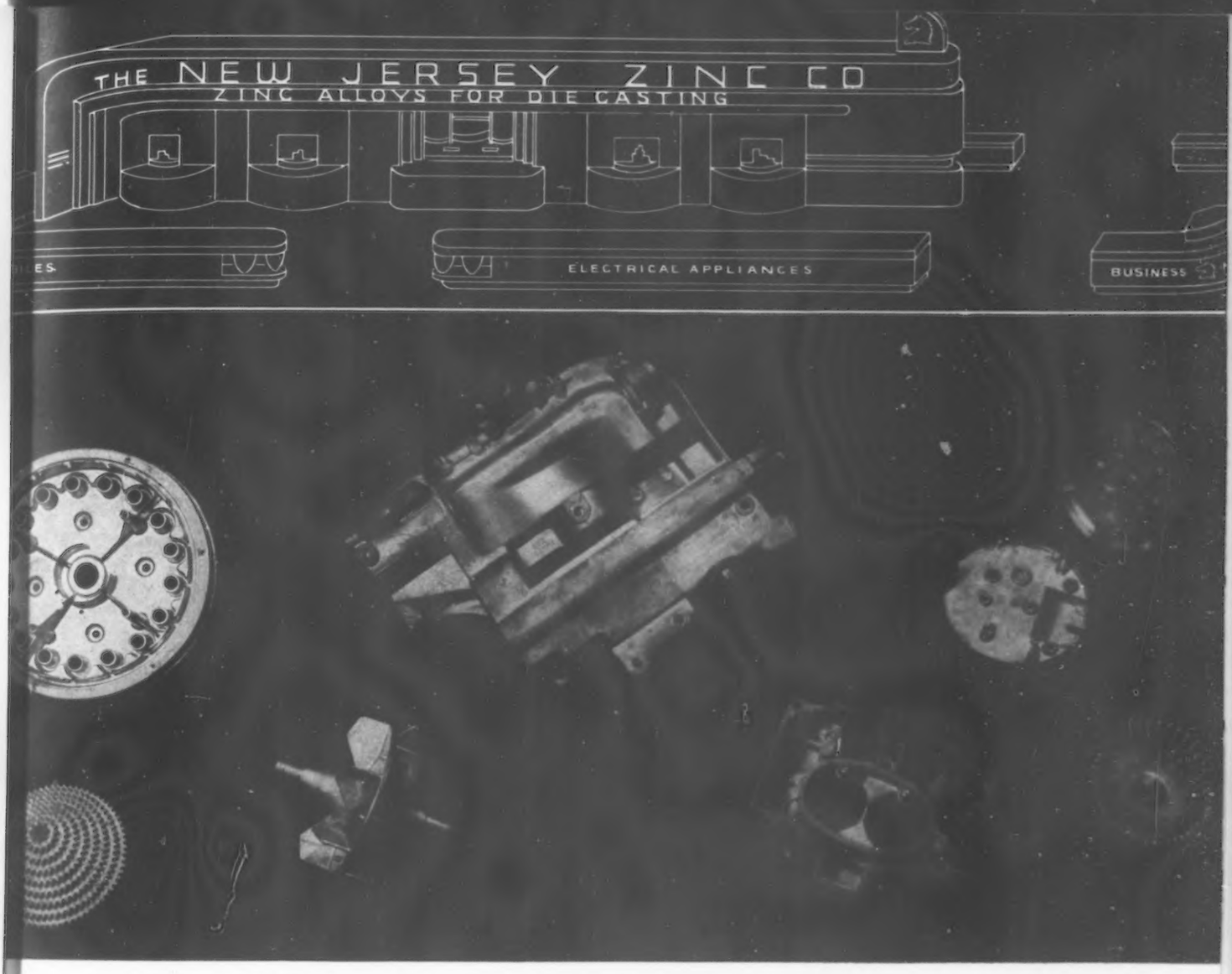
Ask our metallurgical department to recommend proper grades and mixtures of Superior Pure Charcoal Iron for your use. No obligation.

SUPERIOR CHARCOAL IRON CO.

GRAND RAPIDS, MICHIGAN

Debevoise-Anderson Co., Inc., Eastern Representative • NEW YORK • BOSTON • PHILADELPHIA

USE 15% to 25% *Superior* PURE CHARCOAL IRON IN THE MIX



FRANKLY, WE'RE AMAZED!

Unless you are intimately associated with the die casting industry, it will be difficult for you to fully appreciate the spectacular progress of this modern branch of engineering. Since the development of the new alloys, based on Horse Head Special Zinc, the widespread utility of die castings has been inevitable. As metallurgists, we had every confidence in the ability of the metal, but it remained for the die casting engineer, with an amazing skill and ingenuity, to create die castings typified by those shown on this page.

Each year, for the past eight years, the commercial die casters of the country have sent us their outstanding ZINC Alloy Die Casting applications for exhibit at the Annual Metal Expositions. Each year this collection has served as a visual report of progress. Now, in our ninth consecutive display, we present an array of die castings that cannot fail to impress the alert engineer or production man.

Visit us in booths F-32 and F-36, Atlantic City Auditorium, October 18-22, and be convinced of the engineering acceptance of this amazing metal and method.

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET NEW YORK, N. Y.

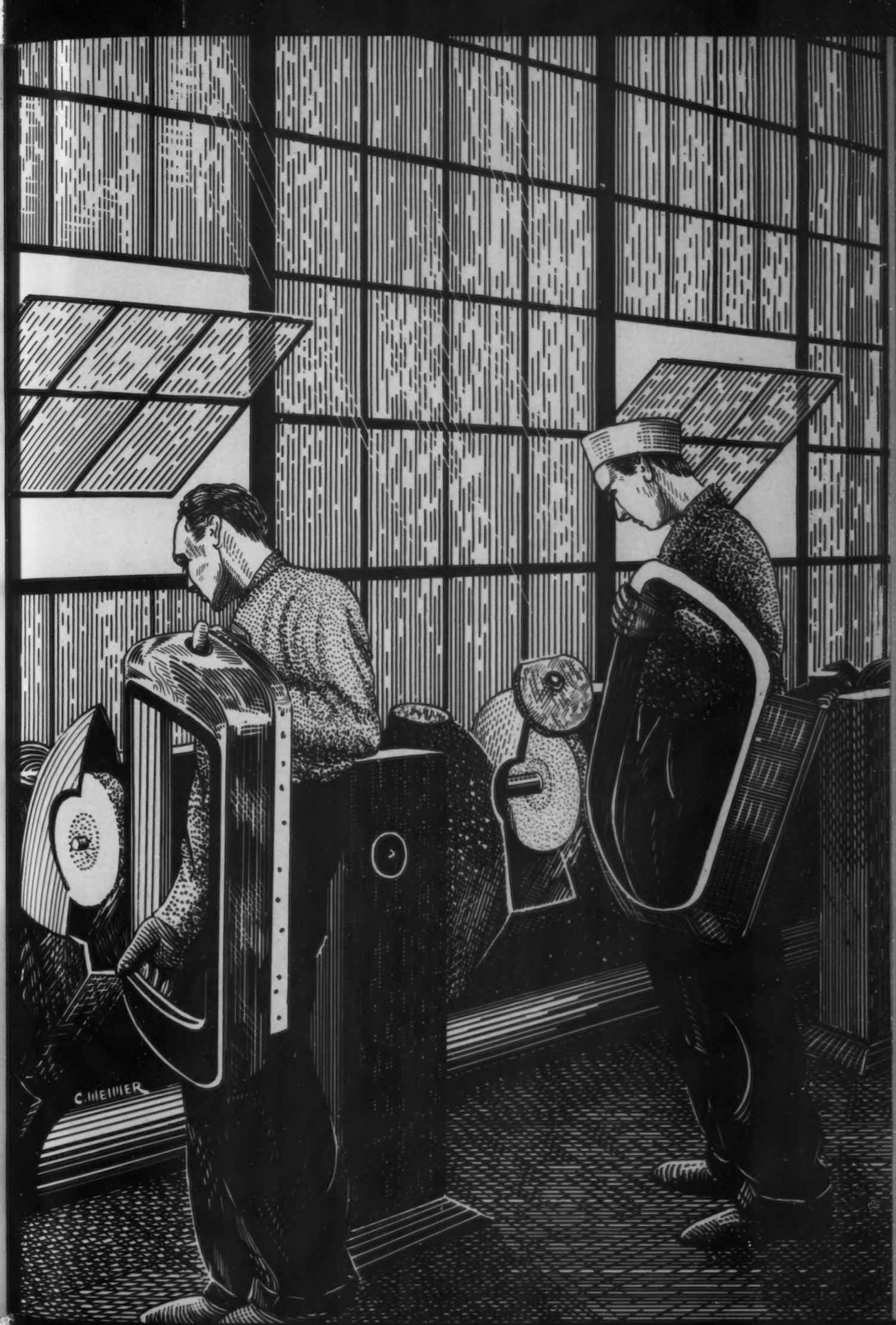
...e Research was done, the Alloys were developed, and most Die Castings are specified wit...

...HORSE HEAD SPECIAL (99.99+% UNIFORM QUALITY) ZINC...

CLEANING AND FINISHING

"IRON is the most useful and the most fatal instrument in the hand of mankind" . . . so said Pliny in 50 B.C. . . . "for by the aid of iron we lay open the ground, we plant trees, we prepare our vineyard-trees. But, iron is used for murders and robberies, and, most criminal of artifices devised by the human mind, iron is given wings and taught to fly to bring death upon man with still greater rapidity. Nature, however, in conformity with her usual benevolence, has limited the power of iron, by inflicting upon it the punishment of rust, and has displayed her usual foresight in rendering nothing in existence more perishable than the substance which brings the greatest dangers upon perishable mortality."

O Pliny, what wouldst thou say if thou didst see and hear the pistols, bombs and cannon of today, or how modern man battles nature's curse to a standstill by coating perishable iron with imperishable metals. Today, this protecting of iron is a broad technical field in its own right, but supplementing it is the technique of properly cleaning the iron surface to secure a lasting protection. The extended and complex problem of cleaning metallic surfaces, both ferrous and non-ferrous, is reduced to fundamentals and explained in detail by Dr. Young in this section.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CLEANING of METALLIC SURFACES

By DR. C. B. F. YOUNG
Instructor, Chemical Engineer, Columbia University

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THREE essentials in this present age of metals is that articles be resistant to corrosion, be attractive and retain their beauty during handling. However, the production methods and economics of today, for the most part, dictate that metals or alloys be used which have none of the foregoing attributes. For instance, many articles are made of iron or steel, but even though this material can be buffed until a smooth finish is obtained, it is equally true the surface rusts with ease, the result being an unattractive and dirty red or red-yellow coating. Again, zinc-base die castings are each day increasingly popular, but these castings will corrode if exposed without treatment to a damp atmosphere. The same story applies for copper, brass and many other metals and alloys.

Thus, the paramount question is how can an attractive finish be produced on metals which is at the same time resistant to corrosion and attractive? One solution would be to substitute stainless steels for white metals, gold alloys for the yellow metals, etc. The economic result alone frustrates this solution, and in addition, stainless steel is a very difficult metal to work. A more common solution is to protect a conventional base material with a thin resistant coating of another metal, and in this way materials which are expensive, hard, attractive, etc., may be used and yet the complete cost of the article is not prohibitive. These protective coatings may be applied as follows:

(A) Metallic coatings:

(1) Hot dip (molten).
(2) Semi hot dip.
(3) Metal spraying.
(4) Electroplating.

(B) Organic coatings:

(1) Lacquering.
(2) Painting.
(3) Varnishing.
(4) Vulcanizing (rubber).

(C) Inorganic coatings:

(1) Oxidizing (producing an oxide film as on iron).
(2) Producing insoluble compounds by chemical reactions (such as phosphate for zinc and sulphate for lead).
(3) Enameling (porcelain ware).

This list covers the methods of finishing practically all metal parts. Analyzing these processes, it is evident that practically all of them require that the base metal surface be absolutely clean prior to the application of the protective coating. The only possible exception is metal spraying, but a rough surface is required and during the roughing operation a partially clean surface is produced.

It may be taken as a fact that if the base metal surface is dirty the applied coatings will have poor adherence, or corrosion resistance, or have an unattractive appearance.

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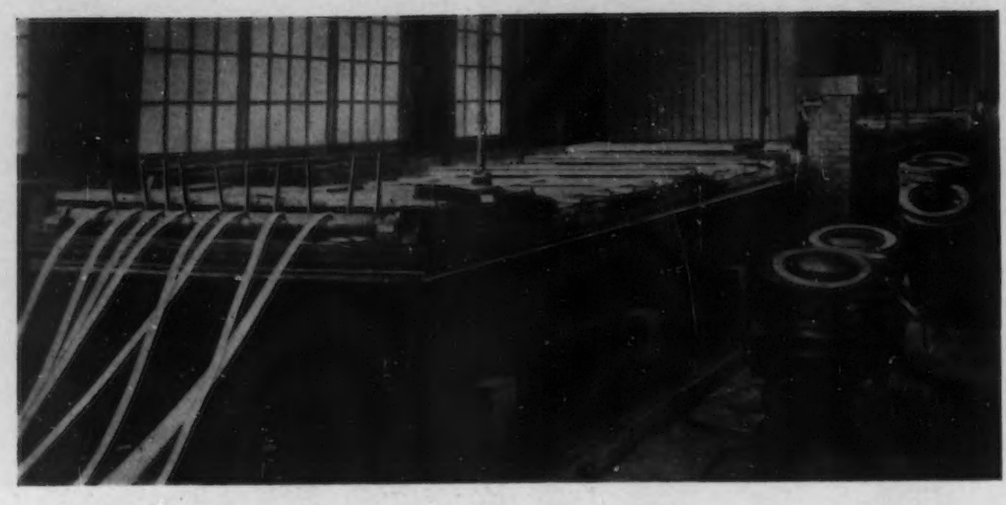

FIG. 1—A continuous strip pickling tank lined with hard rubber. Courtesy of American Hard Rubber Co.

Thus, it is evident why the past decade has been marked by extensive experimentation and exploitation of various procedures for cleaning metallic surfaces.

In a discussion of methods for obtaining clean surfaces, it is rather logical to study the properties of the material to be removed. Three kinds of foreign material are generally encountered and may be classified as follows:

(A) Inorganic materials:
- (1) Oxides.
- (2) Sulphides.
- (3) Basic carbonates, etc.

(B) Organic compounds:
- (1) Oils and greases which will saponify.
- (2) Oils and greases which will not saponify.

(C) Mixtures of (A) and (B).

The foreign materials falling under group (A) are generally caused by heat and/or oxidation. Fire scale, rust and tarnish are all good examples. These coatings, being oxides or sulphides, have a tendency to be basic and will generally dissolve in acids. The acid actually used is dictated by the base metal and the type of film present. Sulphuric, hydrochloric and hydrofluoric acids are employed for pickling steel, while mixtures of sulphuric, nitric, and hydrochloric acids are used for brass, bronze, and copper. If much fire scale is present, a solution of sulphuric acid and sodium dichromate will often be particularly efficient. Hydrofluoric acid is often used to remove from iron and steel the silicon dioxide which is encrusted during the molding process or enclosed during sand blast cleaning.

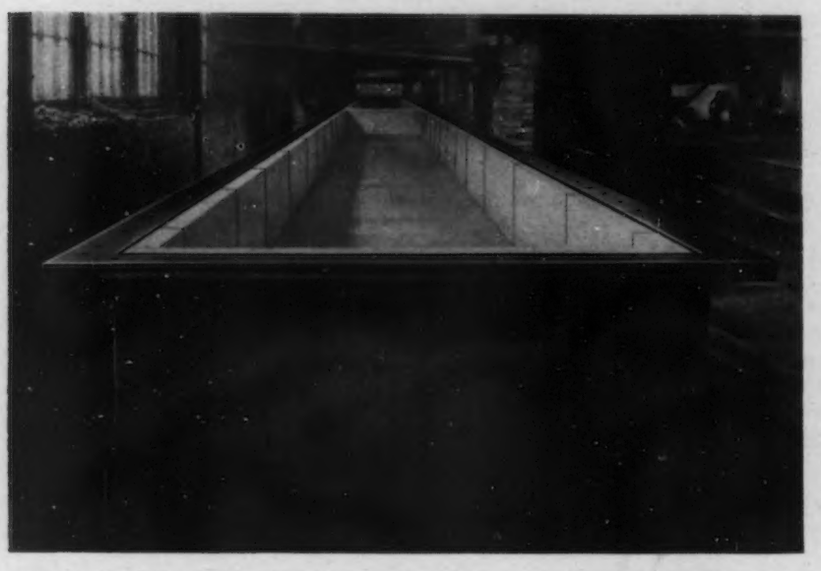

FIG. 2—A rubber-lined tank with stone protection, as made by American Hard Rubber Co. The stone protects the inside of the tank from mechanical abuse.

In certain instances the use of basic solutions will be found advantageous for group (A) films. For instance, copper or brass may be cleaned in a basic cyanide bath. There are many types of solutions for performing this operation, and the constituents and their concentrations will depend on the base metal and the materials to be removed. Sulphuric acid is used to a great extent for cleaning steel prior to galvanizing, etc. The solution contains water, sulphuric acid and an inhibitor. The concentration may be varied over a wide range but a formula which can be used as a starting point follows: 14.7 oz. of sulphuric acid (1.86 sp. gr.) and 0.27 to 1.34 oz. of inhibitor, diluted to make one gallon of solution, and used at a temperature of 110 to 125 deg. F. with an immersion time of 10 to 50 min.

The solution is generally warmed in order to increase the dissolving action of the acid, thereby cutting down the time of immersion and thus increasing the output of an installation.

The tanks used for pickling are usually of welded steel construction, and are lined with various acid-resisting materials. For sulphuric acid baths, lead-lined (6 to 8 lb. per sq. ft.) steel tanks are useful, as this type of material has an excellent service life. Wooden tanks painted with a protective coating are used in some cases, but this construction is losing favor. Concrete lined with mastic is also employed, but this type of tank is generally massive and almost immovable; therefore it must be built in place and remain there throughout its useful service.

A rather recent development is

hard rubber tank lining. A hard rubber is necessary in order to withstand constant abuse, but when vulcanized to the tank and subjected to constant temperature changes there is a constant tendency for the rubber to separate from the steel. However, it was found that if the lining was built up of two layers of rubber, one a soft and the other a hard type, and the former vulcanized to the steel, a lining would be produced which would be elastic near the steel and hard and firm on the outer edge.

Fig. 1 shows a strip pickling tank lined with the combination materials, made up of ⅛ in. of hard rubber and an under layer of 1/16 in. of soft rubber, making a total thickness of 3/16 in. The present price of this material is $2.15 per sq. ft. of inside tank surface. For tanks over 25 ft. in length, the container is made in sections which are assembled by bolting the parts together.

When pickling is carried out at high temperatures, the inside of the tank is protected from mechanical abuse by lining with stone ware, brick, or wood. In this way, rough loading is permissible without endangering the protective coatings. Fig. 2 shows a tank of this type lined with stone protection.

Hard rubber linings are ideal for solutions containing hydrochloric acid, and is recommended especially for pickling solutions containing the chloride radical.

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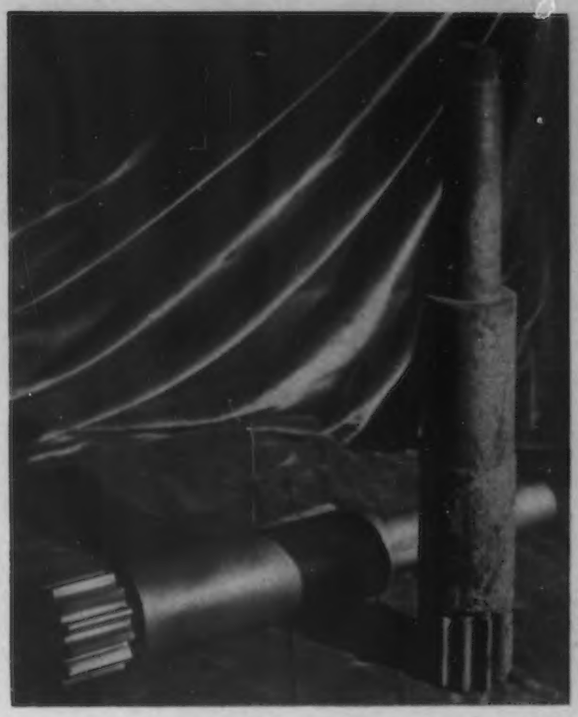

FIG. 3—Two heat-treated steel pinions, one before and one after cleaning by the Bullard-Dunn process. Courtesy of the Bullard-Dunn Co.

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It has previously been mentioned several times that a small amount of inhibitor is added to prevent the formation of pits and aid in producing uniform results. The action of inhibitors is sufficiently interesting to warrant detailed discussion. They may be divided into the following groups:

(A) Insoluble materials:

(1) Light and organic in nature.

(B) Soluble materials:

(1) Inorganic materials.

(2) Organic materials.

The first class is made up of organic materials which are insoluble in water. These materials, being light, float on the surface of the pickling solution, thus forming

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FIG. 4—Fully automatic equipment for the electrolytic descaling of steel, as manufactured by the Bullard-Dunn Co.

• • •

a film which prevents excessive amounts of the solution from escaping. In this way the bath has a longer life and faster pickling properties. These materials only aid indirectly in producing a better etched surface. Bran is a good example of such materials.

The second class is composed of both organic and inorganic materials and these effect directly the etching properties of the solution. The organic materials undoubtedly form colloidal solutions which have a tendency to aid the solution of the scale and retard solution of the base metal. Quite likely this is due to the change of the hydrogen overvoltage. Examples of this group are flour, glycerine, dextrin, etc.

The inorganic materials are rather new in the field of pickling and are applied somewhat differently, but their application should be wide and very helpful if used correctly.

Electrochemical Descaling

By using inorganic inhibitors and electrochemical descaling baths, it is possible to descale ferrous materials without over-etching or producing smudgy, burnt and pitted surfaces. The inhibitors are added to electrochemical descaling baths (to be discussed later) and in this bath the article to be cleaned is made the cathode in a hot sulphuric acid solution which contains an additional agent as a metal salt. The theory is simple. The work is made the cathode, and large amounts of hydrogen are liberated. This, in combination with the sulphuric acid, reduces and dissolves the scale. However, as soon as the work is clean, a thin film of lead or tin is electrodeposited over the metallic area thus exposed, protecting the base metal against any further chemical or electrochemical action. The metals used are tin or lead in the sulphate form. Tin is generally favored over lead because the former gives a brighter appearance and surface defects can be better detected. The tin content of the bath can be supplied by tin anodes which are soluble in a sulphate bath, whereas if lead is used, lead sulphate which is insoluble must have chlorides present so that the lead may be rendered soluble through the formation of lead chloride. Therefore sulphuric acid can be used alone in the case of tin and the serious corroding effect of chlorides, especially on the heating coils, is eliminated. A bath employing lead consists of 6.35 oz. of sulphuric acid, 1.38 oz. hydrochloric acid, 3 oz. sodium chloride, and the smallest workable amount of lead chloride, all diluted to make one gallon of solution; the bath is worked at a current density of 75 amp. per sq. ft.

The chlorides are added, as pointed out earlier, to render the lead anodes soluble, in order that small amounts of lead ions are always present. This lead bath is not as good as a bath using only sulphuric acid and tin sulphate, and hence the latter is now universally favored. The tin bath is also electrolytic, using sulphuric acid and tin sulphate with approximately the same conditions just listed for lead, with the exception that ferrosilicon alloy anodes are used. These anodes are used for a reason which will become apparent later. In order to maintain the tin sulphate concentration of the bath, 1 to 2 per cent of the anode area is tin metal.

A rather interesting fact about this solution is that there is no bleeding or renewing of the bath. The only part of the solution which must be replaced is that which is lost due to "drag out" and chemical action. The iron dissolved goes either in the ferrous or ferric state, and it has been found that iron in the ferric state is detrimental to the operation of the bath—1 to 3 oz. per gal. will decrease the action to a point where the solution is no longer economical to operate. However, if the iron is in the ferrous state, the concentration can be near the saturation point, approximately 10 oz. per gal., without decreasing the activity of the bath.

It has been found by research that silicon-iron alloy, if used as the anode, keeps the iron in the ferrous state. As the concentration of the ferrous sulphate increases, the salt can be removed by lowering the temperature, which causes crystallization of the material. The bath, if lowered to 40 deg. F. removes about 5 oz. per gal. of ferrous sulphate. Thus, by removing the ferrous salts, no bath has to be discarded; thus labor, chemicals and time are saved, and there is no necessity of disposing of spent acid electrolyte which, in itself, is a decided advantage.

When the metal which has been cleaned is withdrawn from the bath, a thin film of tin or lead covers all areas and acts as a protective coating during fabrication. Only a thin film is deposited because of the high current density used. After the first continuous film is laid down, additional metal is deposited as a spongy precipitate which falls off in the solution and is dissolved by the free acid. The thin protective deposit can be removed very readily if desired by making the metal product the anode in a bath containing 12 oz. of sodium hydroxide (NaOH) and 4 oz. of tri-sodium phosphate (Na_3PO_4), diluted to make one gallon of solution. Following the removal of the protective film, the metal product may be electroplated or lacquered, as desired.

This method just described is known commercially as the Bullard-Dunn process, and patents covering its use are controlled by this company.

A rather interesting illustration of the results which may be expected, is shown in Fig. 3, which shows two pieces of heat-treated steel, one before treatment by the Bullard-Dunn process and the other after.

The equipment for cleaning by this method may be secured on the open market, as the method is very similar to electroplating. If large amounts of grease and/or oil is present, alkaline degreasing or solvent degreasing can precede the process. These will be discussed in detail later in this paper. Ordinary lead lined tanks are suitable, as the solution contains only the sulphate radical. The Bullard company manufactures station type conveyors having various capacities.

The process can be manually operated or automatic. Fig. 4 shows a fully automatic station type conveyor made to operate through a sequence of dips. The installation consists of a central column which lifts, indexes, and lowers automatically, the sequence being controlled by an adjustable time clock, and, if desired, manually operated by a push button control. The machine can be adjusted to stop at the top of the lift so as to reduce "drag-out" losses.

Baskets or racks act as containers, and, as all etching is stopped when the base metal is cleaned, there is no material deterioration of this equipment.

Acid Etching Solutions

As evident from the foregoing discussion, it is quite possible to

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use a mixture of sulphuric and hydrochloric acid for cleaning metals. The latter has a tendency to hasten the solution of fire scale or film. A general formula consists of 16 oz. of sulphuric acid and 4 oz. of hydrochloric acid, diluted to form a gallon of solution, which is operated at a temperature of 175 deg. Fahr.

Pickling of Copper, Brass and Bronze

Fire scale can best be removed from copper, brass and bronze by immersing the articles in a solution made up of 6½ oz. of sulphuric acid (1.86 sp. gr.) and 1 oz. of sodium dichromate, the two diluted to make a gallon of solution.

After the fire scale is removed.

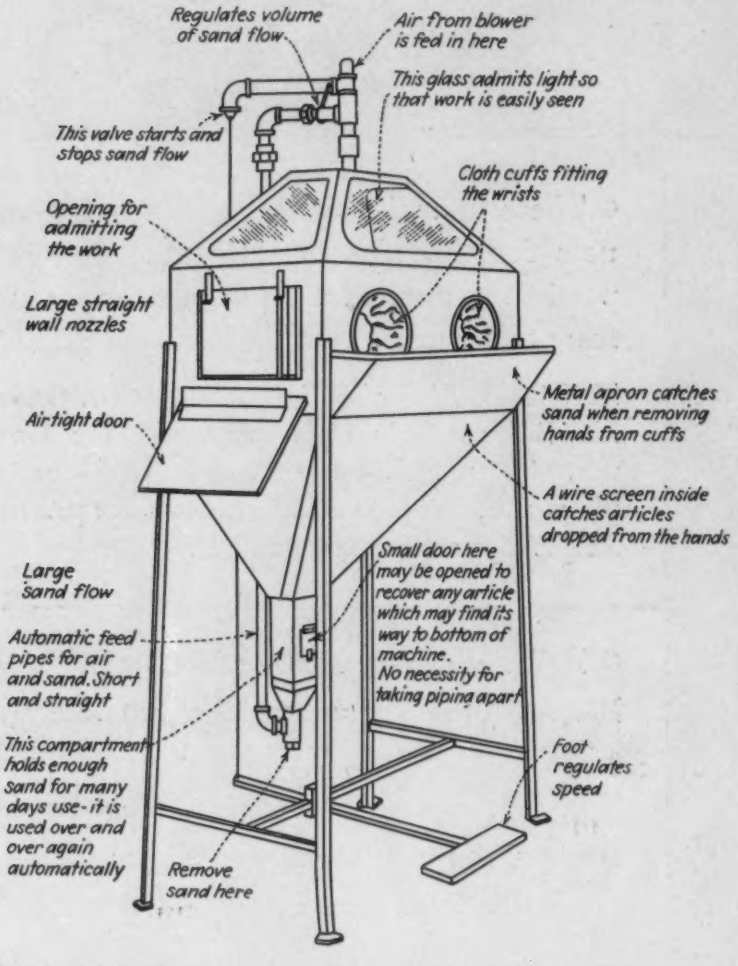
Regulates volume of sand flow
Air from blower is fed in here
This glass admits light so that work is easily seen
This valve starts and stops sand flow
Cloth cuffs fitting the wrists
Opening for admitting the work
Large straight wall nozzles
Metal apron catches sand when removing hands from cuffs
Air tight door
A wire screen inside catches articles dropped from the hands
Small door here may be opened to recover any article which may find its way to bottom of machine. No necessity for taking piping apart
Large sand flow
Automatic feed pipes for air and sand. Short and straight
This compartment holds enough sand for many days use - it is used over and over again automatically
Foot regulates speed
Remove sand here

FIG. 5—A small hand blast machine, as made by Leiman Brothers, New York.

Also, hydrochloric acid or muriatic acid can be used alone. A solution containing 13 to 20 oz. per gal., use at 150 deg. Fahr., will dissolve scale quite rapidly. Note, however, that hydrochloric acid is very corrosive, and for that reason should not be used unless necessary. Rubber lined tanks can be used, but the protection of heating coils is a difficult problem.

As the ferric salts build up, the chemical reaction slows down, until finally these solutions have to be discarded and new solutions made up. it is customary to immerse in another solution which will bright etch the surface. A typical bright dip solution is made up of 120 oz. of sulphuric acid (1.86 sp. gr.), 20 oz. of nitric acid (1.50 sp. gr.), 1.3 oz. of hydrochloric acid (1.18 sp. gr.) and 54 oz. of water.

The solution temperature should not go above 95 deg. Fahr. When in use these bright dips have a tendency to produce different types of etches. This is due to the fact that the acids present are neutralized by reuniting with the metal, and are thereby reduced in concentration; also, the salts of the metals are formed, and continue to increase in the solution. These two factors vary the rate of solution of the metal or alloy, thereby giving rise to different etches. If small amounts of hydrochloric acid are added during usage (0.01 oz. per gal.) the best etching will be constantly obtained.

Pickling of Other Metals

Nickel silver can be cleaned in the same manner as brass although, in many cases, this alloy can be treated with the sulphuric acid solution previously given, the final result being quite satisfactory.

Silver being rather inactive has very little surface oxide. The black deposit generally present (silver sulphide) can best be taken off by abrasion or reduced to the metallic form by immersing the object in a sodium bicarbonate and sodium chloride solution contained in an aluminum tray. The silver becomes the cathode while the aluminum is the anode, thereby reducing the tarnish to pure silver.

Fire scale on silver can be removed by dipping into a hot pickling solution containing two parts by volume of nitric acid (1.50 sp. gr). and one part of water, or by making the material the anode in a solution containing 6.7 oz. of sodium cyanide per gal.

This latter solution is used at room temperature with a current density of 10 to 15 amp. per sq. ft.

Tin, zinc, zinc base die castings and aluminum can all be etched by introducing into a five to ten per cent solution of hydrochloric acid.

Sodium cyanide may be used to clean the above metals also. This solution has the advantage of removing all oxides, etc., without excessively etching or pitting the surface. This can be also used to clean brass, bronze, copper, etc.

Sand Blasting

When large amounts of scale are present on metallic surfaces a very ingenious way of removing the foreign material is by "sand blasting." This consists of introducing the surface to be cleaned into a stream of sand particles traveling at a high rate of speed. These particles are generally propelled by being introduced into a blast or stream of compressed air. The crystals of sand traveling at a high velocity, contact and cut the surface of the metal and in so doing

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remove the foreign material which is present. In the last few years, metallic shot has been substituted for the sand, the subsequent results being quite remarkable.

The amount of cutting will depend on, among other things, the hardness of the metallic shot. This can be varied by using different metals and alloys, thereby producing varying results.

Effects Summarized

From the description given, it can be seen that the effect is purely mechanical. However, this mechanical effect can produce certain undesirable characteristics. The particles impinging upon the surface may produce a type of cold work which results in hardness and brittleness. This is especially true if the metal being treated is in the form of thin sheets. Another surface effect, which may result in poor adhesion of the applied coating is caused by the small crystals of sand being encased in the treated metal. These particles can be eliminated by immersing the metal in a 10 to 30 per cent solution of hydrofluoric acid which will dissolve silicon dioxide.

Sand blasting can also be used on such materials as fibre, hard rubber, celluloid, etc. The big use of this type of cleaning is to free castings from sand.

In all cases it must be emphasized that only matte finishes are produced. However, it is possible to vary the finish produced by using a fine, medium or coarse grade of sand, flint, crushed steel or other abrasive.

Summarized, the advantages of sand blasting are: (1) Unskilled labor may be used; (2) excessive exposure does not ruin the product; (3) finish may be duplicated; (4) foreign materials are removed quickly; and (5) a clean surface is produced. On the other hand, the limitations are: (1) Only matte finishes are produced; (2) does not remove burrs; (3) hardness or brittleness may result due to cold working; (4) air pressure must not be excessive or the work will be warped; and (5) the sand may be encased in the metal surface resulting in poor adhesion for finishes.

The apparatus for carrying out this process consists of a large enclosed area supplied with outlets of compressed air containing sand or metallic shot. The stream of particles is made to contact the work by either moving the object or changing the air stream. The size of the chambers varies directly as the size of the work. Apparatus is built which contains only 2 cu. ft. of enclosed areas, while, in other cases, rooms are used containing 1000 to 1500 cu. ft.

Fig. 5 shows a small hand sand blast machine, as made by Leiman Brothers.

Sand blasting apparatus can be obtained in any size. A typical sand blast room is constructed with wearing plates where the abrasive strikes the wall. The apparatus is illuminated with electric lights so that the operator has good visibility at all times. Up or down draft systems can be installed. Ventilation is so arranged that the air is completely changed from 10 to 15 times per min., as desired. In the floor is located a hopper which is fitted with a steel worm conveyor delivering the refuse from the sand blast room to the bucket elevator, which in turn delivers the refuse into a revolving screen unit which makes three separations of the used material, separating the sand or abrasive from the foreign matter and delivering the former back to automatic-fill positive-pressure sand blasting equipment.

In order to sand blast large quantities of comparatively small articles economically, it is imperative that labor be reduced to a minimum. This can be realized provided a method can be used which will turn the articles being sand blasted in such a manner that all sides are exposed to the cleaning blast. Such a task is rather simply accomplished by combining a barrel type machine with a blast machine. The result is a so-called "sand blast barrel apparatus," which is used extensively. This apparatus is different from the tumbling barrel, as in this case the articles are cleaned by the grinding of the surfaces of the articles with each other or with abrasives which have been added. In the former case (sand blast barrels) the cleaning is accomplished by the impinging of the sand or metallic shot on the surface of the articles to be cleaned. Thus, the abrasive under pressure accounts for the cleaning and not the abrasive action arising from rubbing of the articles.

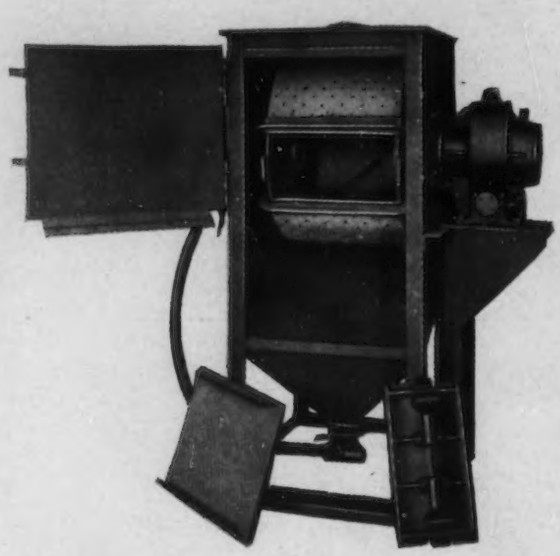

FIG. 6—Suction-type, continuous-feed, single-nozzle sand blast barrel, as made by Pangborn Corp.

Fig. 6 shows a blast barrel which is a suction-type continuous-feed single-nozzle type, used for small work. The rotating drum is made of steel varying from ½ in. to ¾ in. steel depending upon the size. This is protected by heavy sectional headliners and load deflectors, which receive the wear and tear exerted by such an apparatus. This particular drum comes in two sizes, the first being 24 in. in diameter by 15 in. long, having a capacity of ½ cu. ft. The second size is 30 in. in diameter by 20 in. long and has a capacity of 2½ cu. ft. Both sizes automatically unload the cleaned work. The barrels revolve at a very slow speed so that fragile parts can be cleaned without being broken or damaged. The pressure

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are the only casualties in this bombardment

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Once there, Orthosil solutions generate copious quantities of gas, because they are better conductors of electricity than those of almost any other alkaline salt in similar concentration. The gas bubbles lift the dirt violently from the metal, scouring it clean.

Its efficiency in electrolytic cleaning is only one of the advantages of Orthosil. It is outstanding for its quick action. It is unhampered by inert salts and relatively weak alkaline diluents. Because it is an *anhydrous* granular material, it is easy to pour and it dissolves quickly. Why not try Orthosil and check its many advantages? Write for full details—address Department E.

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3. **Prevents grease and dirt from redepositing.**
4. **Easy to pour, quick to dissolve.**
5. **Anhydrous—highly concentrated—economical.**
6. **Quickly removes the grease, soot, dust, and various other kinds of dirt unaffected by pickle acid.**
7. **Leaves material *clean* for further processing.**

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on this type of equipment can be as low as 5 lb. or as high as 100 lb.

A rather inexpensive and yet satisfactory method of sand blasting small parts consists of introducing the sand blast into a tilting tumbling barrel. Such an apparatus is shown in Fig. 7. This apparatus being small can be installed for a low capital investment and does not require any expensive repairs. The tilting feature of this type of machine aids in handling the objects to be cleaned, as all pieces are handled manually. The cover is made of wood. The top is so constructed that a seal is made which prevents the sand particles from escaping. The barrel has sectional, perforated bottom plates which form a pocket with the bottom of the barrel and catches the abrasive scale, dirt, etc. This can be withdrawn through the hollow shaft. At the end of this shaft a trap is located which catches all materials heavier than the abrasive. When a proper amount of this material has collected, the trap door automatically opens and deposits the refuse in a suitable container. On the other hand, the sand which becomes too fine to be of use is automatically carried away through an exhaust hose, along with the molding sand or scale which has been cleaned from the castings. From the illustration it can be seen that the articles are exposed on all sides to the blast by the slow rotation of the apparatus.

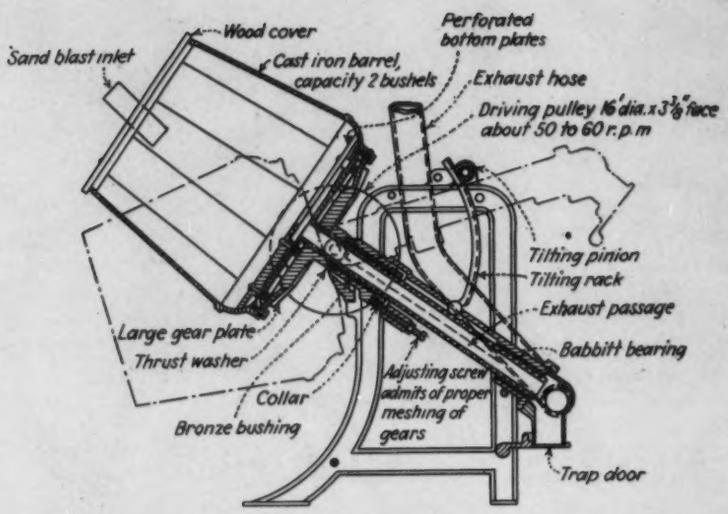

FIG. 7—Inexpensive tumbling barrel with sand blast, for cleaning small parts. Courtesy of Baird Machine Co.

What might be called a product of the depression was placed on the market some three or four years ago. This product utilized a method for cleaning castings, forgings, and stamped metal parts, which does not require the aid of compressed air. The method used consists of introducing metallic shot into the veins of a revolving wheel. The force derived is terrific as the wheel speed is over two thousand r.p.m. The abrasive is directed by a patented device which controls the direction of particles leaving the revolving wheel. With this device the abrasive can be directed onto the work, thus making the process economically feasible.

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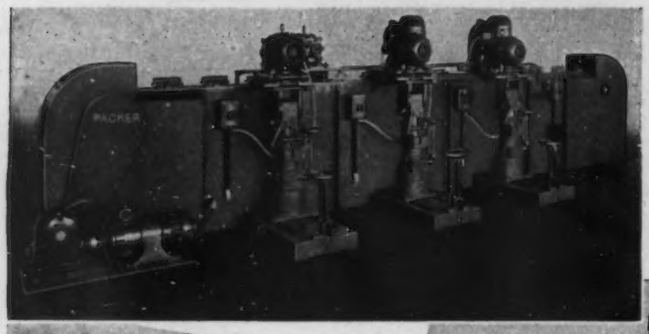

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Fig. 8 shows such an apparatus with the guard removed. The illustration shows how the particles are introduced to the rapid moving wheel. This type of cleaner does away with compressed air, compressors, hose pipe connections, nozzles, tanks, valves, mixing chambers, etc. The motor used is only 15 hp., whereas a corresponding air blast will require 100 to 150 hp.

The method can be applied to table or tumbling type apparatus. An airless or "Rotoblast" barrel machine is designed for general cleaning and performs the task in rapid time with economy. The set consists of a "rotoblast" unit, the drum, the abrasive reconditionizing system, the machine housing and the automatic loader. The unit has a load capacity of 3000 lb. or 16 cu. ft., and can be charged or discharged in 100 sec. This equipment is used for cleaning castings, forgings, and stampings.

In some cases the table type abrading machines are desired rather than the tumbling type, particularly for cleaning fragile articles. Fig. 9 shows an airless abrasive table which is used for cleaning meter boxes. This consists of a revolving table which exposes the work to the blast for one-half revolution, and on coming out the material is ready to remove. The speed of the table can be varied so that degrees of cleaning can be obtained.

Cost of Airless Abrasion

In several surveys made by one engineering concern (A. C. Nielson Co.) it was found that a 48x42 Wheelabrator Tum-Blast machine cleaned forgings, castings, etc., to a brighter finish and yet at a lower cost than compressed air methods. At one plant the Wheelabrator Tum-Blast, manufactured by the American Foundry Equipment Co., cleaned forgings at $0.954 per ton as compared with the shot blast method costing $1.48 per ton, a reduction in cost of 35.4 per cent.

The advantages claimed for the airless cleaners are: (1) Only steel shot is used, therefore the silicosis hazard is decreased; (2) life of the apparatus appears to be at least ten years; (3) no compressed air is needed, therefore compressors, pipe liner, mixing chambers, air traps, hose, nozzles, are all eliminated; (4) power required is approximately 1/10 that of other methods; (5) total cost of cleaning is lower due to lower cost of equipment; (6) special types of cabinets can be equipped so as to clean cylinder blocks, gears, brake drums, pipes, etc.; and (7) hydrogen embrittlement is not produced or particles of sand enclosed in the surface of the metal.

The limitations of the machines may be summarized as follows: (1) The apparatus is new, therefore the exact life is not known; and (2) the nature of the equipment is destructive so wearable parts must be replaced.

Rattling

This type of metal cleaning is one of the very oldest procedures for removing foreign materials from castings. It is sometimes known as rumbling or tumbling or rolling. The name rattling is applied to the process because of the noise which is always present during the operation. The process is

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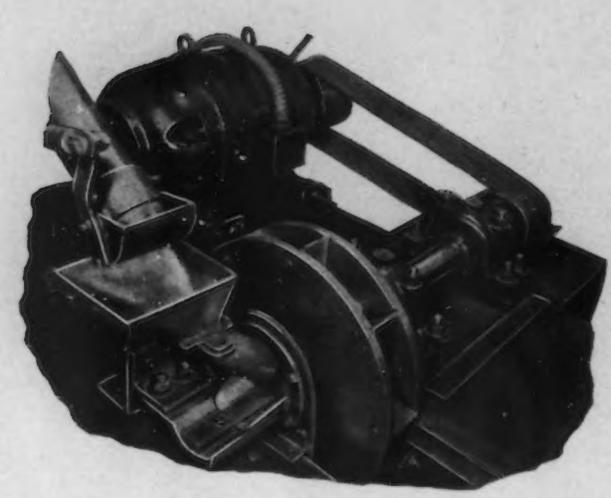

FIG. 8—Centrifugal blast machine with guard removed. Courtesy of American Foundry Equipment Co.

generally carried out in the dry state but this is not a fast rule. There are many wet installations in use at the present time.

Tumbling or rumbling is a method of producing a comparatively clean surface by introducing the work into a rotating barrel containing stars, jacks, metal slugs and some type of abrasive such as sand, slag, pumice, etc. The work is always packed tight and the barrel completely filled so that the work does not move about. Only the small jacks, etc., move as the load is rotated. This is the cheapest method of cleaning castings to a rather bright, shiny and uniform surface. Generally speaking, tumbling is carried out in the dry state. The time of operation will vary according to the shape, size, material, and condition of the object under consideration. From 3 to 24 hr. or longer covers the entire range.

Rolling consists of rotating a barrel which contains a load of work and some type of abrasive. The barrel is not loaded to capacity as in the above case and the work is free to move about during the rotation of the container. The abrasives used may vary in size, shape, and hardness. Examples are sand, ground slag, pumice, emery, alundum, carborundum, rouge, etc. The container may be either horizontal, closed or open and tilted barrels.

FIG. 9—Airless abrasive table equipment, as made by Pangborn Corp.

If the process is carried out in the wet state, chemicals which will aid in removing scale, etc., may be dissolved in the water. In this way there is simultaneous mechanical and chemical action.

The speed of rotation for the open tilted barrel is 20 to 60 r.p.m. The speed is always adjusted so that the work has a gentle rolling, sliding motion. The angle of inclination can be varied for different effects. Progress of the batch can always be observed by the operator.

In many instances an auxiliary load of wood blocks, scrap metal, steel balls, etc., is added so that the abrasive is carried to all corners of the work.

The amount of water added should be sufficient to make a wet paste. Additional water must be supplied from time to time as the heat generated by the continual falling of the work evaporates the water present. If allowed to become too dry, the abrasive sticks and thus minimizes the cutting action.

Fig. 10 shows an old type of tumbler. The dimensions depend on the size of the work, and may vary from 2 ft. to 5 ft. in diameter and 3 ft. to 20 ft. in length. The apparatus shown is made with steel channel staves which are attached to the ends by bolts. For loading or unloading, the equipment is stopped so that the two staves having handles attached are stopped in the position shown. Four bolts are released in each section, then slipped out of socket, and the staves removed. Rattlers are generally lined or partially lined with oak or other hard wood.

These machines are partially filled or filled with work and a definite quantity of jacks, stars, or bolts added, so that some of the sand is ground very fine and suspended as a dust in the surrounding atmosphere. This dust is objectionable and unhealthy for workmen, but it may be made "dustless" by drawing large volumes of air through the rattler and sending the suspension to a dust collector. The air is generally pulled through a hollow shaft. The process can also be run in the wet state, thereby eliminating this trouble.

When the process is complete, the barrel is stopped in the correct position, the staves removed and the work separated from the stars, jacks, etc. This is a rather costly

operation as the labor required, although cheap, adds to the operating cost. Until recently the industry has refused to do anything about this condition. At least one manufacturer of equipment has instigated important research which has produced some interesting equipment, including the removal of the dust hazard, the separation of the stars and grit and the automatic ejection of work. Such an apparatus is shown in Fig. 11, which is an end-loading star-returning mill used for cleaning forged and cast parts.

The labor involved for operating this mill is very low, as a power charger injects the work and the apparatus ejects it. On loading, the drum rotates for the desired

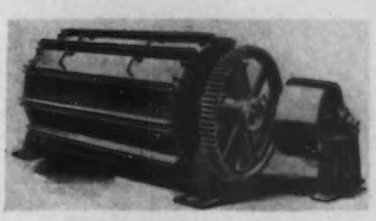

FIG. 10—A type of tumbler made by Tabor Mfg. Co.

time, and, on completion, the drum is rotated in the opposite direction. The stars, jacks, etc., are thus separated from the work placed in a cone-shaped jacket, and at the same time discharged. If the mill is then rotated in the original tumbling direction, the stars or jacks automatically return to the tumbling compartment. This transfer and separation of the cleaning material from the work is accomplished by a special cup arrangement of simple and rigid design which is placed in the head, between the tumbling compartment and the cone surrounding the separating screen. A door in the cone permits the removal of stars when replacement is necessary.

If a dry process is used, the mill is equipped with an exhaust hood for connection to any standard exhaust system. If a wet process is employed, drainage connections are supplied. These machines are built with tumbling compartments from 36x36 in. to 50x84 in.

Hoppers may be substituted for the power loader shown in the illustration. This type of equipment is also built as a side-loading star-returning mill.

The art of rolling is about as old as that of tumbling, both having been practiced for centuries. The process can be carried out either in the wet or dry state. If wet, chemicals can be dissolved in the water to react chemically with the scale and help to remove it. Some kind of abrasive is also used which aids in cutting down the surface. The combined chemical and abrasive action minimizes the operating time. This method is a rather inexpensive procedure for preparing castings for ball burnishing.

The apparatus for carrying qut the rolling process is similar to machines used for burnishing or tumbling.

Burnishing

This operation consists of obtaining a smooth surface by smoothing out all irergularities. This

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is accomplished by reducing the irregularities to an even surface by rubbing the work together or between hardened steel balls. A lubricant is added which prevents metal to metal contact, thereby eliminating scratches and abrasions. The lubricant also aids in obtaining a high surface lustre on the metal.

During the "smoothing out" operation, the metal not only becomes brighter but also cleaner. The scrubbing action scours the surface so that all foreign materials are removed, and for this reason burnishing is really two operations in one.

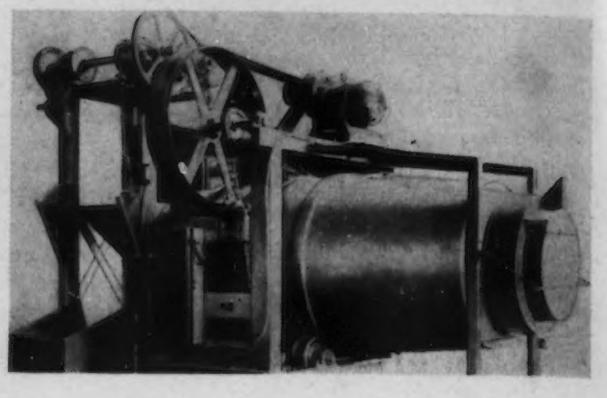

FIG. 11—End-loading, star-returning equipment for cleaning forged and cast articles. Courtesy of N. Ransohoff, Inc.

Burnishing is a comparatively young process, being about 40 years old. During this time much information has been obtained with reference to classification of the work, lubricating and burnishing agents. Any good neutral soap chips will serve as a lubricant, a charge consisting of one cup to each load of 2 cu. ft.

Burnishing apparatus consists of a revolving barrel, generally manually loaded. Also, the burnishing balls, if used, must be separated by screening or some other similar method. However, study has aided this field as well as the tumbling process. Fig. 12 shows an apparatus which will ball burnish, separate the articles from the balls, return the balls to the burnishing compartment and empty the work. A very definite saving in time and labor is thus realized. The work is loaded into the barrel through a door in the periphery. A cylindrical screen is attached to the end of the burnishing section and connected to it by a suitable passage, and this screen is surrounded by a cone for retaining the balls after separation from the work, the cone being connected to the burnishing compartment.

After the burnishing has been completed, reversing the direction of rotation discharges the work and the balls into the screen. Here the balls are separated from the work, the former falling through the perforations in the screen into the surrounding cone and the latter passing out from the end of the screen. The barrel is then stopped and loaded with another batch of work. Running again in the burnishing direction automatically returns the

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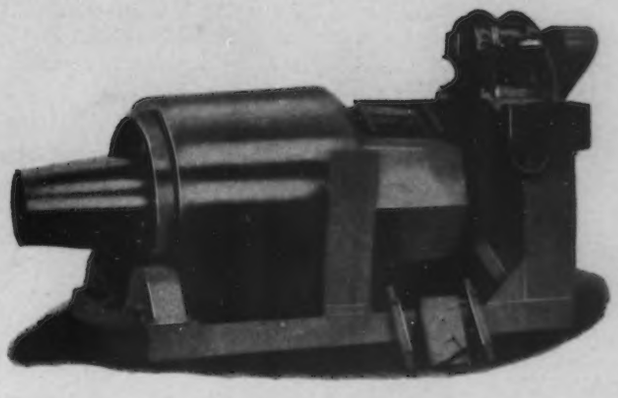

FIG. 12—Automatic burnisher which separates the balls from the work. Made by N. Ransohoff, Inc.

o o o

balls from the cone to the burnishing section. This automatic handling of the balls eliminates all the labor of handling them and the time required to empty and reload the barrel is about 5 min., as compared to 30 min. for the old type of barrel where manual separation of the balls from the work and the manual return of them to the barrel were necessary. It is claimed by the manufacturers that in addition to this saving, a greater quantity of balls can be used than is economical in the old type of barrel, thereby resulting in faster burnishing action.

The advantage of the end discharge is that it permits a greater diameter in the burnishing compartment without excessive loading height. This greater diameter and the use of more balls produce an increased burnishing pressure resulting in better and faster operations, while the end discharge also permits the whole equipment to be built close to the floor. This apparatus is built with burnishing compartments from 24x24 in. to 36x36 in.

Smaller machines are also manufactured using the above principle. Fig. 13 shows a small automatic ball return burnishing barrel for operations on smaller batches. The tumbling compartment is hexagonal, 24 in. side to side, 12 in. deep. It is charged with the small door up, discharged with the small door down direct to "tote" pans under the machine. Larger work may be placed in the barrel by removing the head, which is held in place by a single central screw. The ball compartment is behind the perforated brass plate.

In operation, the loaded barrel is tilted to about 5 deg. below horizontal and run in the burnishing direction. Balls are automatically transferred to a 1-in. space just behind the perforated plate through which they work to the burnishing compartment.

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the barrel is tilted to 10 or 15 deg. above horizontal and the direction of rotation is reversed. (Tilting is easily effected by the crank at the right.) Rotating in reverse, the balls sift out of the work through the perforated plate and are transferred into the ball compartment. This separation is exceedingly rapid and thorough. It takes only 5 to 7 min. to separate balls from the cupped work.

Provision is made for rinsing work and balls while the barrel is rotating, by a hollow shaft which admits water to the burnishing compartment when the barrel is tilted up and in reverse. The water washes through the work, passes through the perforated plate into the ball compartment and escapes through a valve, screen-protected to prevent loss of balls.

The barrel is furnished lined with wood or unlined. It is claimed by the manufacturer that its price is so little above that of old-fashioned barrels that are without the automatic ball return feature that the economy of the investment becomes obvious.

Removal of Organic Materials

Up to the present the discussion has been dealing with methods and apparatus for removing inorganic materials. Our attention will now be turned to the second group of dirts as outlined in the first part of the article. This group is divided into two parts; the materials of one part will saponify, while the other substances will not. The materials in group B1 are composed of animal or vegetable fats. These fats are salts which are formed by an organic acid uniting with an alcohol. These materials being saponifiable means that the compound will react with an alkali forming a metallic salt and glycerine. The metallic salt thus formed is nothing more than a soap. It is common knowedge that fats are insoluble in water while ordinary soap is soluble. Thus, the insoluble grease or fat is converted into a soluble product which can be easily dissolved in water and then removed from the surface. The alkali generally used is sodium hydroxide because of its cheapness and solubility, and high ionization constant which makes it quite reactive.

The composition of cleaners are many and varied. Different types of grease demand different cleaners. It is impossible to give one formula for a cleaning compound and say that it would work for all occasions, although some general

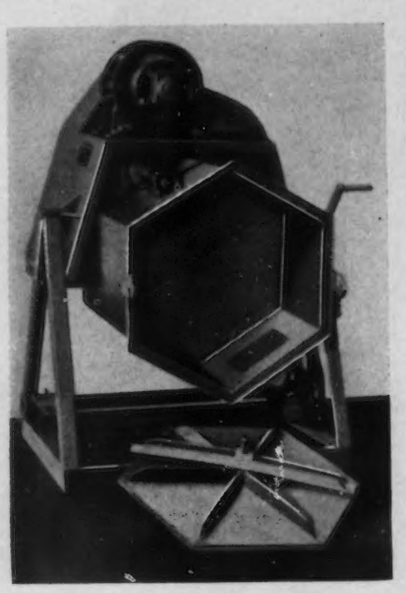

FIG. 13—Small, automatic, ball-returning burnishing machine, as made by N. Ransohoff, Inc.

rules may be laid down which will be helpful. Often pre-mixed cleaners are sold at very high prices, but this is more of an exception than a rule. The materials making up a cleaner are not expensive and the cleaner therefore should not be too expensive.

A good cleaner for saponification alone will contain only sodium hydroxide. However, good cleaners should not only clean by saponification, but also by emulsification. The last mentioned process will be discussed later. Therefore, a good cleaner will contain: (1) Free alkali or a material which will produce the alkali by hydrolysis; (2) a material which will aid in the formation of emulsions; and (3) if desired, solid particles such as alumina which aids the cleaning.

A good cleaning mixture for ferrous materials is as follows: 4 oz. of sodium hydroxide (NaOH); 3 oz. of trisodium phosphate (Na_3PO_4), and 4 oz. of sodium cyanide (NaCN), all diluted to 1 gal. of solution.

This solution should be used at 200 deg. F., and the work placed in and allowed to soak. The free hydroxide will convert any saponifiable fat to a soluble soap and the latter when formed will aid the emulsification of any unsaponifiable oils.

For cleaning zinc, zinc base die castings and aluminum, strong alkali should be omitted from the solution. In its place, sodium carbonates or trisodium phosphate can be used. Sodium cyanide will also remove oxidized products from copper and brass. A solution containing 4 to 5 oz. per gal. of sodium cyanide will clean aluminum, copper, brass, and bronze without pitting or excessively etching the surface.

Electrolytic Cleaning

If the object to be cleaned is made either the anode or cathode in the basic solution, and 15 to 40 amp. per sq. ft. passed through, a great amount of agitation is produced at the electrodes due to churning of the solutions by the liberated gases. This is known as electrolytic cleaning. The cleaning action is produced chemically and electrochemically. If the object is the cathode, the gas released is hydrogen which provides a reducing atmosphere and also produces a thorough scrubbing. Many times the object to be cleaned has solder on its surface. The basic properties of the solution dissolves the tin, lead, and zinc, of the solder, but immediately they are deposited over the surface of the cathode by the electric current. This results in poor adhesion and should be removed before the finished coating is applied. This can be accomplished by using a double throw switch on the tank so that the polarity can be changed while the work is still immersed. Thus by throwing the switch the cathode becomes the anode and any zinc, copper, etc., will be dissolved. This anodic cleaning should require only 10 to 40 sec. The work as removed is chemically clean.

A good solution to be used for electrolytic cleaning contains: 2 oz. of sodium hydroxide (NaOH); 2 oz. of sodium cyanide (NaCN), and 2 oz. of trisodium phosphate (Na_3PO_4), all diluted to 1 gal. of solutions. The conditions are as follows: 15 to 40 amp. per sq. ft., current density, a temperature of 200 deg. F., an emf. of 6 to 12 volts, and a time of 1 to 4 min.

(TO BE CONTINUED IN THE ISSUE OF OCTOBER 21)

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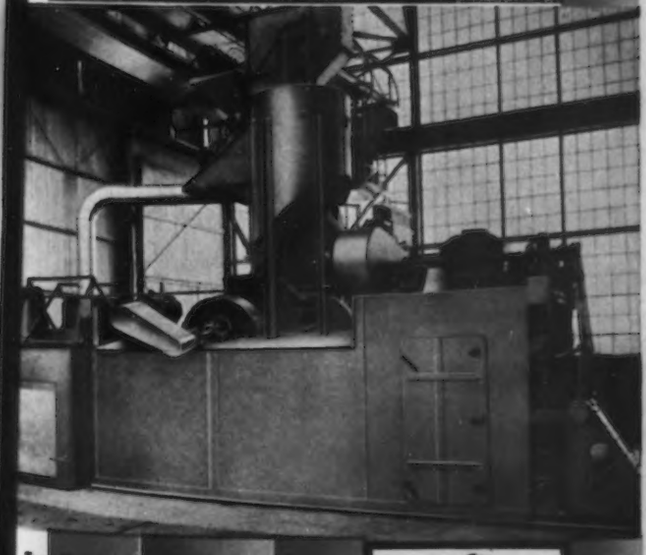

Top: Two Tumblasts Wheelabrating Brake Drums.

Center: Wheelabrating intricate parts on a Tablast.

Below: Wheelabrator Production Unit for cleaning large-sized parts.

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Wheelabrating means throwing approximately 300 lbs. of abrasive per minute by centrifugal force in a fan-spread against the work being cleaned, providing complete coverage of every surface of the work exposed to the blast. No matter how tough the cleaning job may be, subjected to the abrading blast of the Wheelabrator, "they come clean!"

The Wheelabrator method of cleaning is available in the Tumblast — for tumbling-blasting of formed parts, forgings, castings, stampings, and heat treated parts of average size; in the Tablast for blast-cleaning of fragile and thin-section parts; and in the American Utility Cabinet for shops with limited production or for plants requiring an auxiliary unit for cleaning small quantities of intricate work.

Special Wheelabrator Production Systems involving the use of one or more Wheelabrator Units are also available for cleaning sheets, strips, bars, plates, tubes, steel drums or other metal parts, or assemblies.

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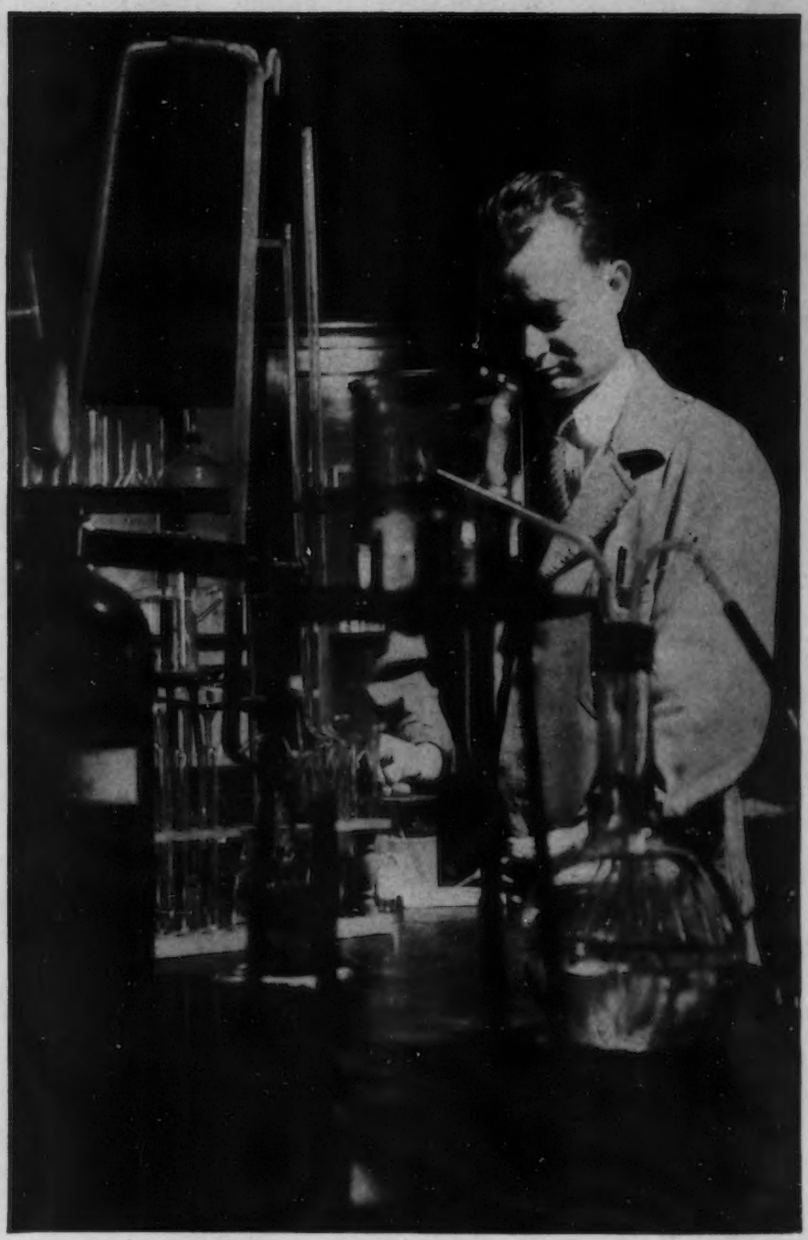

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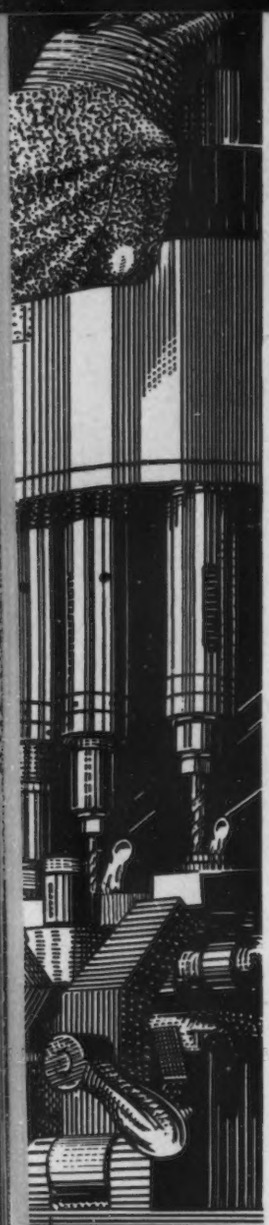

MACHINERY AND TOOLS

IN Aristotle's time there was in Cyprus a breed of mice capable of gnawing iron. Those mice must have had high-speed teeth, or the iron was awfully rotten, or Aristotle was unwittingly propagating a canard. In any case, men have spent the intervening 2000 years trying to gnaw iron not with teeth, but with tools, to get it in a usable form. Up to 1800 there were no machine shops and no machine tools, but the following century was the heyday of the machine tool designer, so much so that a prominent writer in 1900 said, . . . "all possibilities have been attempted, and it seems quite safe to say that no new methods of cutting and shaping metals will be discovered."

That expert quite naturally could not foresee the Taylor and White exhibit of a radically new high-speed cutting steel at the Paris Exhibition a few months later, or the cemented tungsten carbides creating a sensation several decades later, or the complex machine tools of a mass-production era. He could hardly vision one plant machining 70-ton turbine rotors to the thousandths, or the automatic machining of millions of tiny parts for motors, meters, and instruments, all requiring an advanced technique of the highest order. This technique and these modern machine tools are the subject of Mr. Gangwere's article in this section.

"BLAZING NEW TRAILS"

THE Frontier did not die with the passing of the old pioneers and covered wagons.

A new generation of pioneers has sprung up to reassert the spirit of initiative and progress in the field of science.

The JESSOP STEEL COMPANY, a Company with an enviable history reaching back many decades, has always been, and intends to continue, pioneering—blazing new trails. The Jessop Steel Company was one of the first companies to open the industrial frontiers of Stainless Steels, High Speed Steel Sheets, Composite Steels and many others.

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MACHINING TECHNIQUE for ELECTRICAL EQUIPMENT

By E. D. GANGWERE*

o o o

THIS review covers practically the entire machine tool industry, inasmuch as it comments on all the tools used to make all varieties of electrical equipment, ranging from a 165,000-kw. turbine generator unit to small meters.

A portion of Westinghouse's products requires standard machine tools, such as lathes, planers, boring mills, drill presses, slotters, milling machines, and other production machines of all types. Other products are of such design as to allow the use of special high-production set-ups, both as individual parts and occasionally as a complete line of product.

Cemented tungsten carbide cutting tools are used extensively on machines throughout the shop, as this material minimizes grinding time and helps hold gage sizes on automatic set-ups. Types of work on which this hard metal will not perform satisfactorily are machined by using high-speed steel and special tipped tools.

Some of the machine tools in operation and the equipment they manufacture are considered in moderate detail in the following paragraphs and the accompanying photographs.

The South Philadelphia works of Westinghouse is engaged principally in the manufacture of steam turbines and their auxiliaries; or more specifically central power stations, industrial, marine propulsions, reduction gears, pumps, condensers, air coolers and feed water heaters.

It is obvious that such products are highly diversified and require standard (not the standard as offered by the machine tool builders for the average machine shop, but principally as to type) universal equipment. The tools must be rugged and yet accurate to meet general exacting tolerances, particularly so for making high-speed and high-pressure turbine parts.

In the case of a turbine, a particular part will weigh various amounts as the design changes, and for this reason that part which is machined on a horizontal mill today will be worked on a vertical boring mill or drill press tomorrow.

Many castings for steam turbines are inherently complex, and are most difficult problems for the foundry to solve, inasmuch as the

* Equipment, Inspection and Test Department, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

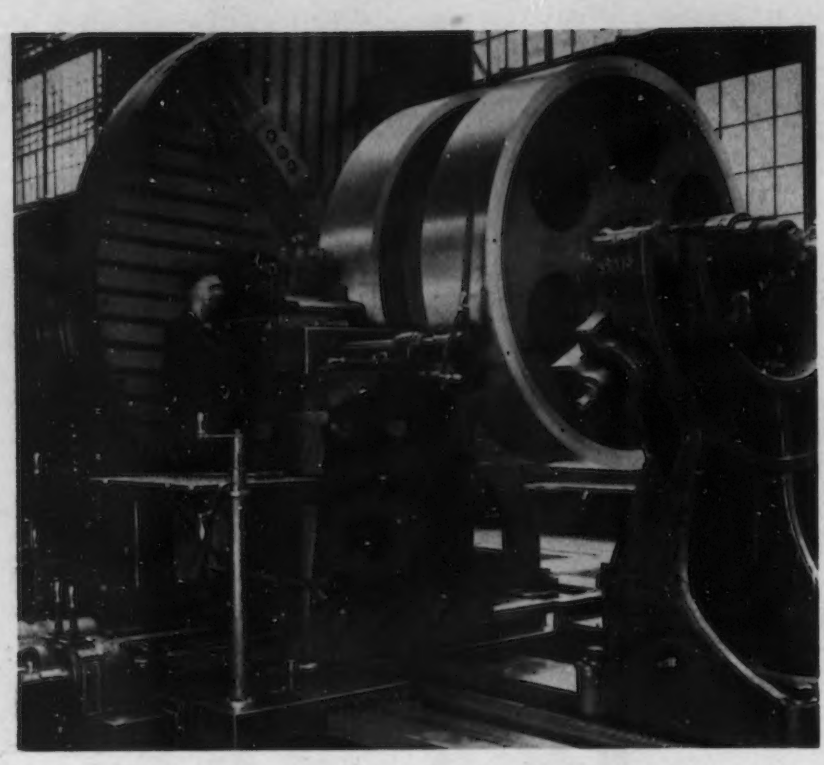


FIG. 1—This 160-in. engine lathe is an exceptionally large machine; but it holds a 115-in. herringbone gear center and rim to 0.0002 in. concentricity.

uniformity in stock to be removed in machining is an unknown quantity, and this stock may be removed either by planing, milling or grinding. Variations in design, tolerances, and the quantity of similar parts present a corresponding variation in machining methods on engine lathes, turret lathes, and sometimes can even be tooled for the radial drill press.

A wider variety of materials than that used in steam turbine manufacture cannot be found in any other diversified industry. This variety creates another problem for consideration, that is the selection of the standard type, universal machine, since a particular machine may be required to turn up soft brass bar stock, iron, the toughest alloy metals, as well as hard or high-carbon steels.

The versatility and range of capacity of the South Philadelphia works have been proved by its ability to handle the much talked about 200-in. telescope to be erected on Palomar Mountain in California; a portion of the telescope known as the observation cage was fabricated from various formed steel bars and plates and machined on a 32-ft. swing vertical boring mill.

Extra fine finishes and close tolerances are a daily diet on all turbine parts at South Philadelphia. An outstanding piece of apparatus made there is a 165,000-kw. turbine, the low pressure rotor of which weighed approximately 127,000 lb., completely machined without blades. The tip speed of the longest blade that forms the steam paths of this turbine is 13 miles per min. at normal speed, which gives a good idea of the strain on these blades while they are in operation. Stainless steel is used in their manufacture, and, after forging to shape, the blades are very carefully machined to close tolerances to give them a correct shape and weight.

The South Philadelphia plant also has a complete turret lathe or screw machine department, and is required to perform very close work on atomizer nozzles, valve seats and jet nozzles.

FIG. 2—This machine is used for projection welding fins to compressor shells. The lower, or revolving arm of the welder, is indexed to irregularly space the fins.

Automatic Welding

In the turbine manufacturing divisions one of the outstanding operations is the use of special machines and tools to groove cylinders and rotors, which must be spaced and turned or bored to plus or minus 0.001 in.

The 160-in. lathe shown in Fig. 1 is machining a 115-in. diameter herringbone gear center and rim, which must be held to 0.0002 in. concentricity. The face of each helical is 15 in. The tooth pressure on the final gear is 676 lb. per in. of face, and the gear rating at full speed load is 250 r.p.m.

There are several very interesting applications of machine tools

IN THE SERVICE OF INDUSTRY

Single type herringbone reducer driving coal mine hoist

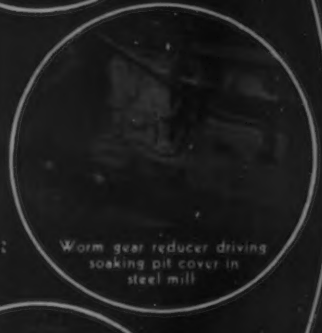
Double type herringbone reducer driving head shaft of standard elevator in cement mill

V-Belt drive to double herringbone reducer driving inclined flight conveyor in coal tipple

THERE is just a fleeting glance at the tremendously broad scope of Jones service to industry in drive problems. These few installations are typical of the thousands of applications of Jones herringbone, worm and spur gear speed reducers for every type of service.

There are many sound reasons why these thousands of organizations have selected Jones equipment . . . reasons which we believe you will also find sound and convincing. In any case you may be sure that we shall be pleased to place complete information in your hands covering speed reducers and other Jones transmission products.

Part of battery of spur gear speed reducers driving travelling water screens in power plant



Worm gear reducer driving soaking pit cover in steel mill

Spur gear reducer straight line drive to belt conveyor in coke plant

Worm gear reducer driving tumbling mill

Worm gear speed reducer driving belt feeder in paper mill

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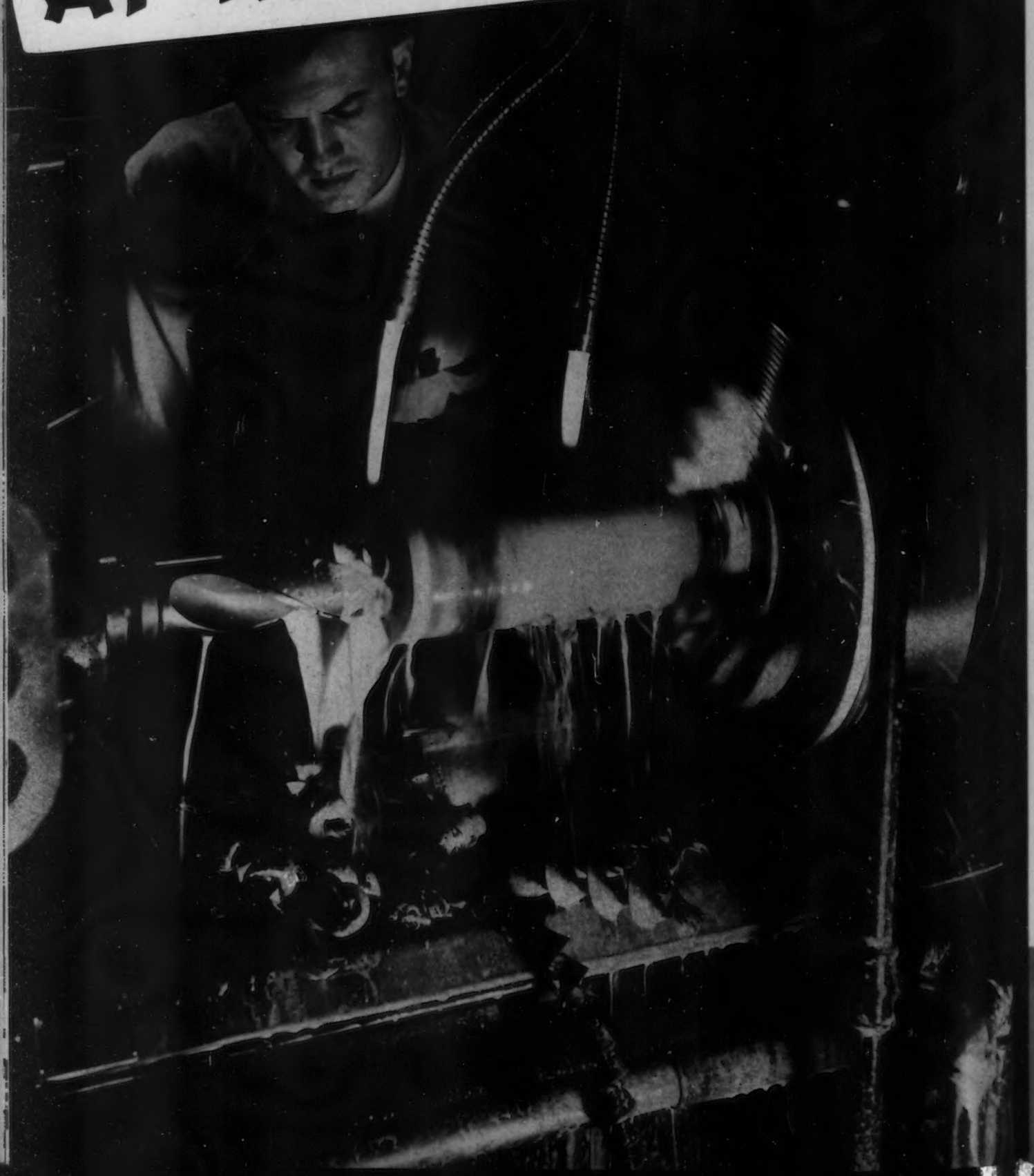

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with SUNOCO

Power . . . rigidity . . . flexibility . . . accuracy built in the modern lathe for high-speed production and fine finish depend to a great extent on the cutting fluid.

SUNOCO's performance has won the approval of many machine tool builders. Outstanding among them is the Warner & Swasey Company, who know from experience that SUNOCO will aid their machines to perform at rated capacity and produce accurate, fine-finish work.

SUNOCO assures fast, chatter-free, clean-cutting action at the point of the tool. Tools wear longer and produce more pieces per tool grind.

In your shop . . . with your material . . . under your own working conditions, test SUNOCO. It will demonstrate and convince you of its value as an aid in machine tool efficiency.

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Heavy Duty Bar Turner taking a heavy cut
Warner & Swasey 2-A Universal Heavy Duty Turret La

The Warner & Swasey 3-A Universal Heavy Duty Tu
Lathe (Bar capacity of machine 4½"—Swing 23

Photos courtesy of The Warner & Swasey Co.

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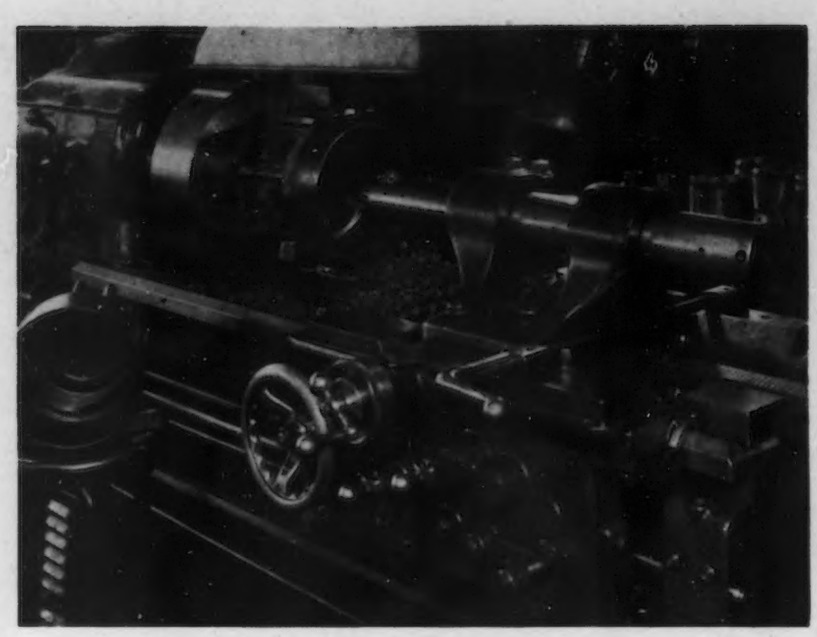

FIG. 3—The foot-operated air chuck on this engine lathe permits the operator to handle the compressor shell with both hands.

in the Westinghouse refrigerator and air conditioning plant, as for instance, the projection welding of fins to compressor shells, as shown in Fig. 2.

The welding is accomplished by the series method, and the lower or revolving arm of the welder is indexed automatically by special arrangements to take care of the irregular spacing of the fins. The operator starts the machine after loading, and the machine will complete its cycle and then stop. The welding cycle is controlled by the Ignitron timer method.

These compressor shells are machined for motor fit on an engine lathe arranged with a foot-operated air chuck and special boring bar mounted on the lathe carriage, which has also a power rapid traverse to eliminate operator fatigue.

The shell sizes are held to a very close accuracy, and it has been necessary to remove the compound and to install a large boring bar. The foot-operated air chuck was installed so that the operator would have both hands free to chuck the piece to be machined. This operation is shown in Fig. 3.

A very unique arrangement of drilling equipment is shown in Fig. 4 where drilling, counterboring and tapping have been combined in an 18-spindle machine; the six right hand heads are arranged for tapping. The two front stations are for loading, and when the table is indexed the other heads perform their operations automatically without the operator's attention.

This type of equipment is only practical when the quantities handled by the machine warrant the expenditure necessary for designing and building a special machine, but the final result is well worth while. In the case of these cylinder heads, a very accurate job at low cost is secured.

Crankpin and wrist pin holes are ground in one setting in a shuttle-type fixture which gives the correct throw. Due to the accuracy required and the size of the holes, both the size-matic and gage-matic principles of sizing are employed, which has eliminated errors and has made assembly costs more uniform.

Fig. 5 shows a variety of work which requires holes of accurate size being bored on a hydraulically operated double boring machine The set-up time on this machine is quite short, which makes the unit ideal for handling quantities.

In the machining of air conditioning crank cases, which are bored and faced on a horizontal boring mill as shown in Fig. 6, a special tooling is arranged; note that the machine is equipped with dial indicators and special auxiliary controls to assist in controlling the movements while working the outer end of casting.

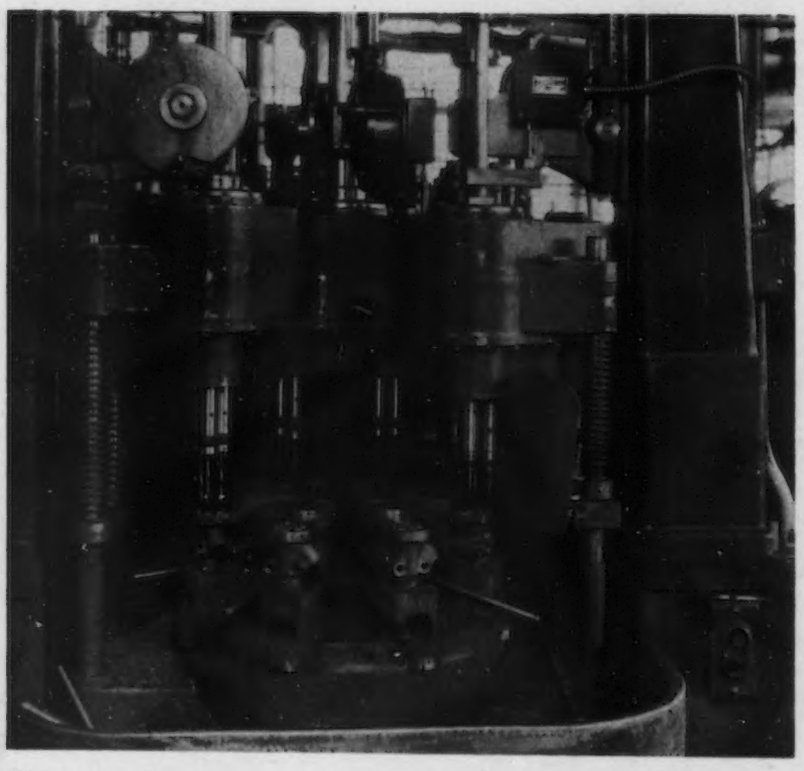

FIG. 4—A unique arrangement of drilling equipment, which drills, counterbores and taps. Only heavy production can justify the designing and building of a special machine such as this one.

Quantity Production

The manufacture of circuit breakers and switch details requires a large variety of miscellaneous equipment, in which stand-

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The constant turning, twisting surge of power from a motor shaft requires a rigid one-piece frame to maintain accurate alignment of electrical parts. This alignment is provided in Westinghouse CS Motors by the RIGID ONE-PIECE FRAME.

Moreover, Westinghouse combines with this great feature the *plus* values of SEALED SLEEVE BEARINGS and DUAL-PROTECTED WINDINGS with *taped end-turns*. In no other motor will you find *all three* of the necessary fundamentals for More Motor Mileage. For complete information, call your nearest:

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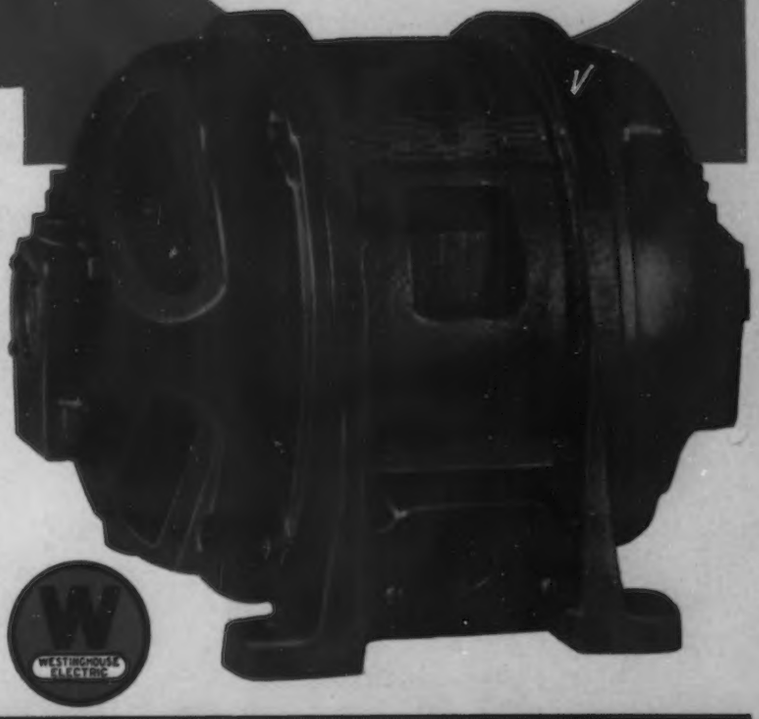

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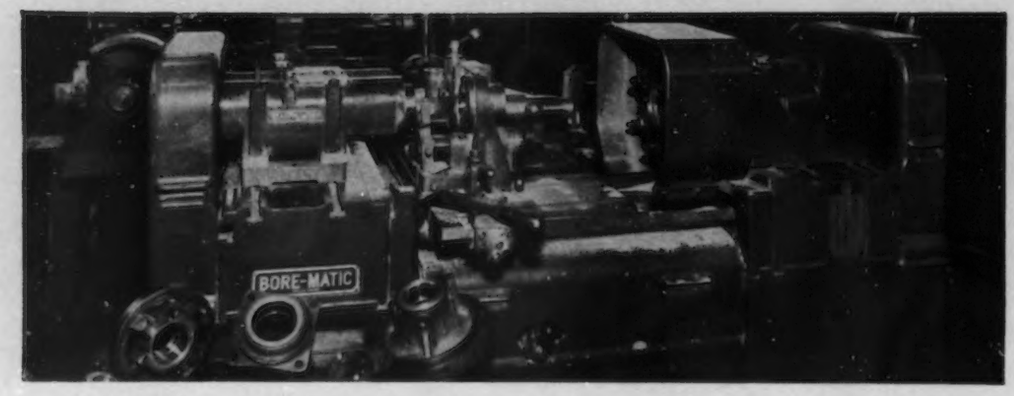

FIG. 5—A hydraulically operated double boring machine which bores holes of high accuracy. Set-up time is quite short.

ard and special machine tools are used and special jigs and tool equipment have been developed to facilitate quantity production.

Small switch fingers are assembled on an air press which has a rotary disk for feeding the work. The operator places the finger base on a fixture, along with a rivet, spring, washer and a shunt. The machine crimps the shunt, sets the finger shape and rivets the finger together in successive stations. Ten fingers are assembled and riveted per minute.

Mold and jigs are machined on a duplicating profiler to insure duplication of design and sizes, all of which saves considerable time.

Where a large amount of detail equipment is manufactured, screw machine details are used extensively. These machines are arranged to turn, thread, drill and tap small details needed in manufacture. This department has automatic machines from 3½ in. diameter capacity to ⅜ in. capacity, and a large variety of second operation machines. For manufacturing small quantities of details there is a number of hand screw machines, from ⅜ in. to 2½ in. capacity. A second operation and inspection of screw machine details are very essential for good screw machine work, and simplifies many assemble operations which would otherwise cause trouble.

In the small De-ion Breaker department there are several unique arrangements of tools, such as in Fig. 7 which shows a press arranged for notching and piercing side sheets. Note the extra dies on the bench, which is used when longer sheets are required. This shows the simplicity of set-up, when a product is designed so that definite multiples can be added or withdrawn to suit the unit to be produced. These dies punch the

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HANNA Cylinders may be mounted vertically, horizontally or in any other position and deliver the same powerful, smooth, positive thrust or pull motion.

Select an operation in your plant involving a pushing, pulling, lifting or lowering motion and compare cost of doing it with a Hanna Cylinder.

TO LEARN PRICE OF CYLINDER SPECIFY FOLLOWING:
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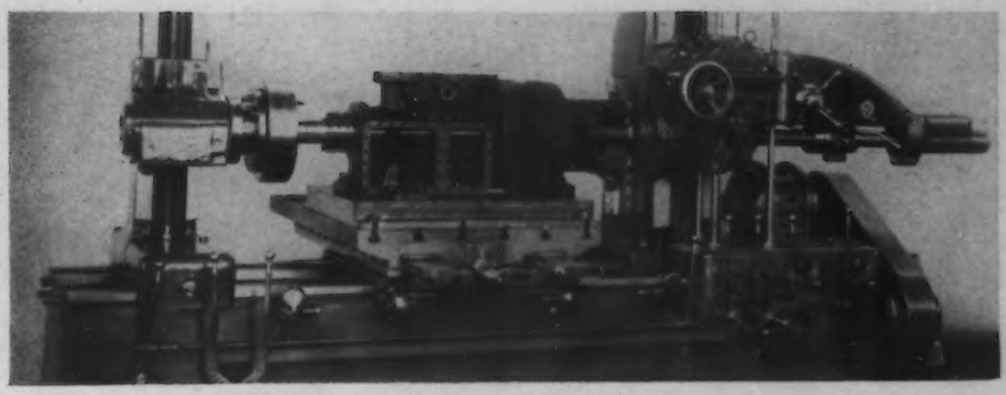


FIG. 6—Note the dial indicators and special auxiliary controls to assist in handling this horizontal boring mill while working at the far end of the machine.

mounting holes for the frame and are changed to suit the panel length, the latter of which is made to inclose the number of individual switches specified by a customer.

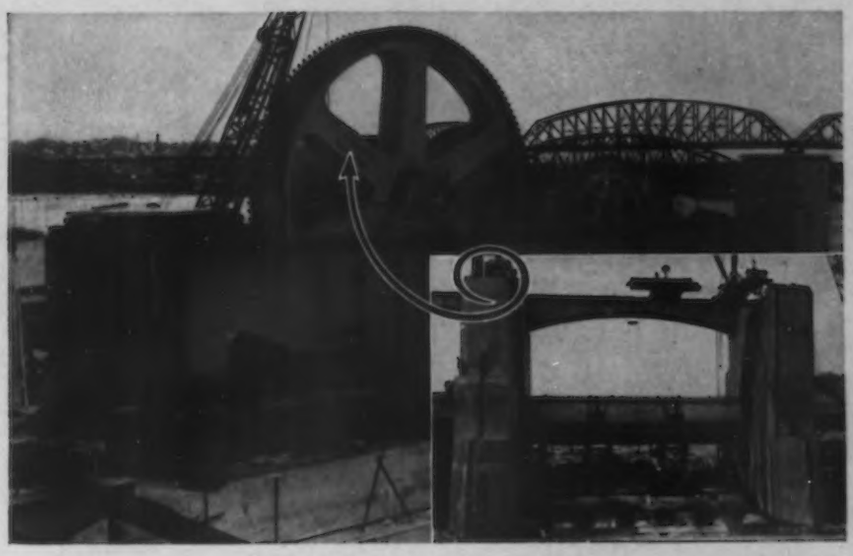
The first operation on punched or blanked parts for the breakers is usually performed on a punch press with roll feed and scrap cutting attachments. Fig. 9 shows several of these machines in operation. Care must be taken in the design of dies for these operations in order that scrap and material clear the die as soon as possible, so they will not interfere with the uniform progression of the material through the roller feed.

Wherever possible shunts and fingers for the current breakers are either brazed or welded together to give good current carrying contacts. Each of the electrically operated welders has a very sensitive control; the welding is timed automatically, after the operator assembles the work between the contacts and starts the machine. Each welder has a capacity of 30 spots per minute.

The small rotary-head punch shown in Fig. 9 is a good time-saver where holes of a variety of size must be punched in panels, or similar work. The rotary head carries punches and dies, from ⅛ in. to ½ in., and can be changed from one size to another in a short time interval.

There are several tool and fixture manufacturing and repair departments at Westinghouse which have a variety of machine tools for all classes of work. Fig. 10 shows a drill press trepanning a disk from a high-speed steel plate, which will later be used for a die.

Die filing machines are used to file slots in dies, punches and strippers, and they do an accurate job much faster than filing by hand. Strippers made by brazing lami-



FARREL-SYKES PRECISION GEARS CHOSEN FOR LOW SPEED OPERATION

The advantages of Farrel-Sykes Precision Herringbone Gears for high speed operation are generally well known. Their use in the hoists for the roller gate dams shown in the illustrations also demonstrates their superiority for *very low speeds.*

The hoist mechanism contains three reductions of herringbone gears and one worm gear. The total ratio is 4850 to 1 and the largest herringbone gear operates at ⅛ R.P.M. . . . *one revolution in eight minutes.*

It can readily be seen that operating conditions in this application impose heavy loads on the gears and a high degree of precision is essential to prevent excessive stresses on the gear teeth.

That Farrel-Sykes Gears successfully meet all the requirements is shown by the fact that they are used in the hoists for fifteen roller gate dams. Their use has resulted in material savings in size, weight and cost, as well as increased efficiency and reliability of operation.

FARREL SYKES GEARS

FARREL-BIRMINGHAM COMPANY, Inc.
333 VULCAN STREET - - - - - BUFFALO, N. Y.
The Gear with a Backbone

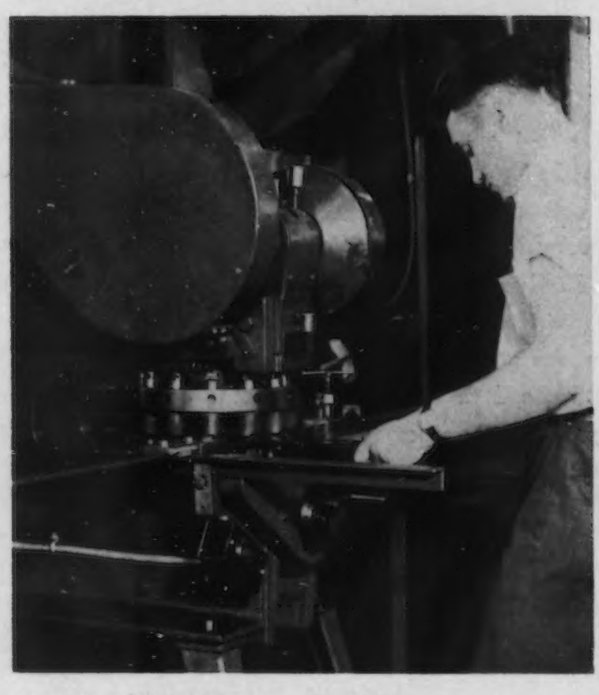


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FIG. 7—(Above) This steel notching and punching press has extra dies so that a variety of plate sizes can be handled. Fig. 8—(Middle) Each of these steel blanking machines has a roll feed and scrap cutting attachment. Fig. 9—(Below) This small rotary punch press handles sizes from 1/8 in. to 1/2 in.; the change-over takes only a short time.

o o o

nated punchings together are filed to correct size without the use of other machines. Interesting lathe, high speed shaper, and duplicating profile work is performed in addition to regular repair and grinding of tools.

In an electrical manufacturing plant, the treating and handling of magnet wire is a subject which requires considerable thought, and in the past few years the Westinghouse enameling and covering equipment has been replaced or brought up to standard. Seven new enameling machines have been installed, having a capacity of 400,000 lb. of (No. 12 to 25 B.&S. gage) magnet wire per month. In addition there are other machines which each month can enamel 50,000 lb. of fine wire, ranging in size from No. 26 to No. 40 B.&S. gage.

This equipment is in a new fireproof building, and a washing system to remove fumes from the exhaust of the enameling towers has been installed. This washing system also reduces fire hazards.

Some of the covering machines use a synchronized motor system between the flyer and capstan, which eliminates the usual mechanical drive. A constant tension torque motor is used for the take-up of the finished wire. These types of machines are equipped with an automatic device which stops the machine in case the covering material should break.

Machines in Molding Department

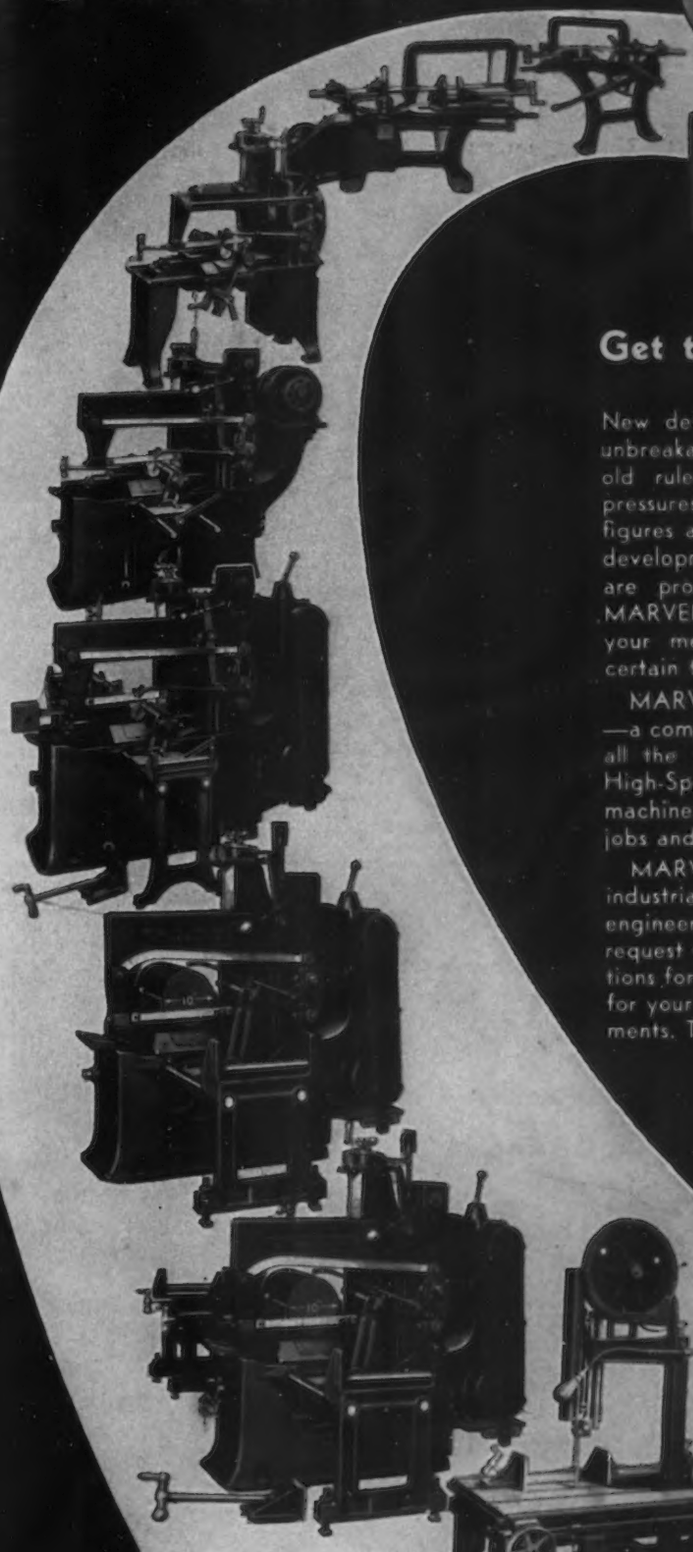
In Westinghouse's molded material department, a very efficient air-operated rotary press has been developed to punch out 36 molded holes at once, in a bracket where it is necessary to size mounting holes.

The operator places molded brackets in recesses on the face of a revolving disk and it is automatically indexed to a pressing position at which point a press operating 25 times a minute punches three brackets of twelve holes each at every stroke.

This molding department makes small molded base commutators. The bars and mica strips are assembled and placed in a small fixture. A knurled brass bushing is placed on a pin in fixture, and the correct amount of compound is then inserted and pressed, using

MARVEL SAWS

..a complete line



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MARVEL offers a complete SYSTEM for metal sawing —a complete and revolutionary line of modern equipment all the way from the positively unbreakable MARVEL High-Speed-Edge Blades through all the various sawing machines, each particularly adapted to individual sawing jobs and requirements.

MARVEL sales engineers, located in all the large industrial centers, are competent to render consulting engineering service on all cutting off problems—on request will call, analyze your work and make recommendations for the most efficient sawing equipment and methods for your particular range of work and production requirements. This service is given without obligation or cost.

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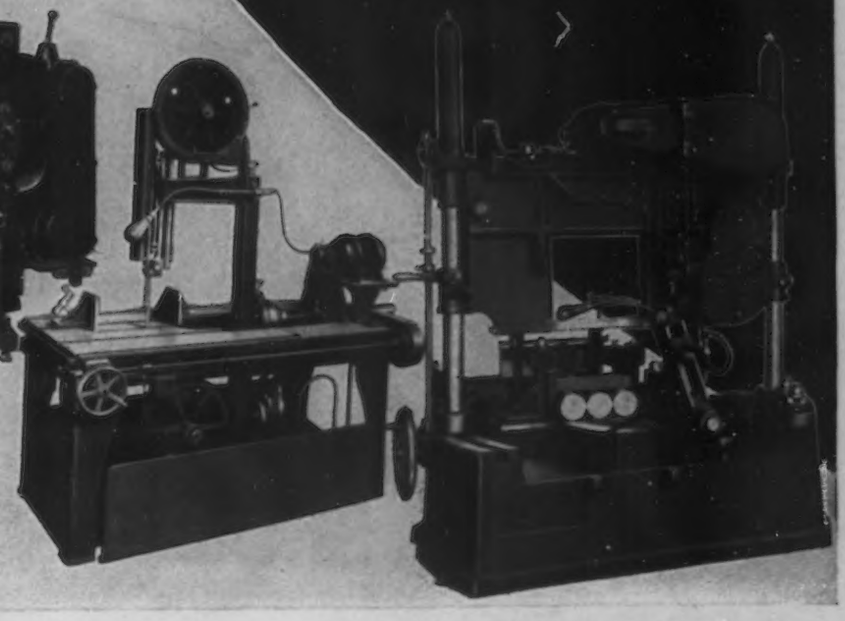


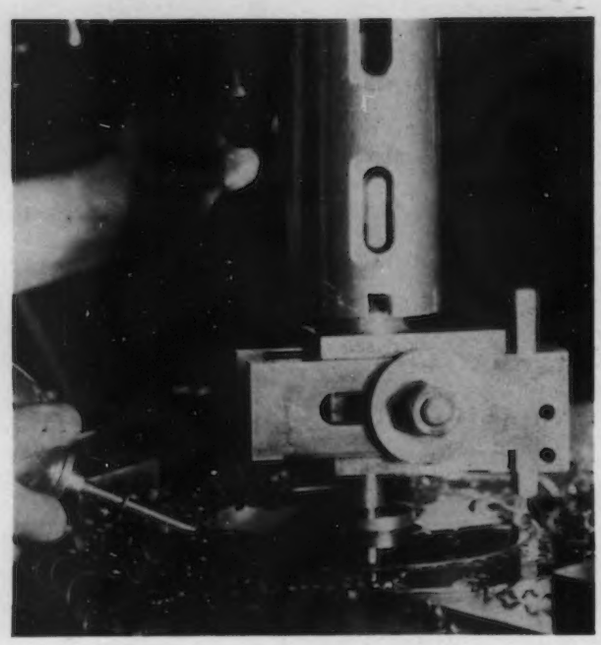


FIG. 10—This drill press is trepanning a high-speed steel disk, which will later be used in a die.

steam for heat and hydraulic pressure.

This department has 3000-lb. and 2000-lb. hydraulic accumulating systems and a large number of presses of different size which will mold a large variety of work.

The Westinghouse Micarta Works has some new developments, one of the most interesting of these being the development of micarta bearings used in all types of metal rolling equipment. These bearings are molded to the correct inside and outside dimensions and the approximate arc, the molding taking place at a temperature of 356 deg. F. and at a pressure of 1 ton per sq. in. Under this pressure and heat the rosin binder undergoes a chemical change which renders it very hard and infusible, and after cooling in the molds the bearings are removed. They are then cut to the correct length and arc, and the water chamfer is cut in, all on one milling machine, as shown in Fig. 11.

Because of the hardness of the special resin developed for these micarta bearings, it has been necessary to develop tools made from cemented tungsten carbide for use in machining No. 271 micarta, as high-speed steel will not hold a cutting edge.

FIG. 11—Milling machine finishing micarta bearings.

Laminated micarta plate is processed in sheets 96 in. long by 48 in. wide in the two presses shown in Fig. 12. Treated sheets of the material are stacked between metal pressing plates and then placed between steam heated platens. A total hydraulic pressure of 7,500,000 lb. is applied to the press, which produces a unit pressure of 1600 lb. per sq. in. on the material to be molded. The platens are heated with steam to 392 deg. F., which is maintained very accurately throughout the molding cycle.

These plates are used for decorative purposes, and are made in various colors and grains to suit the trade, and also have a fine mirror-like finish which will withstand the action of rough usage and liquids generally encountered.

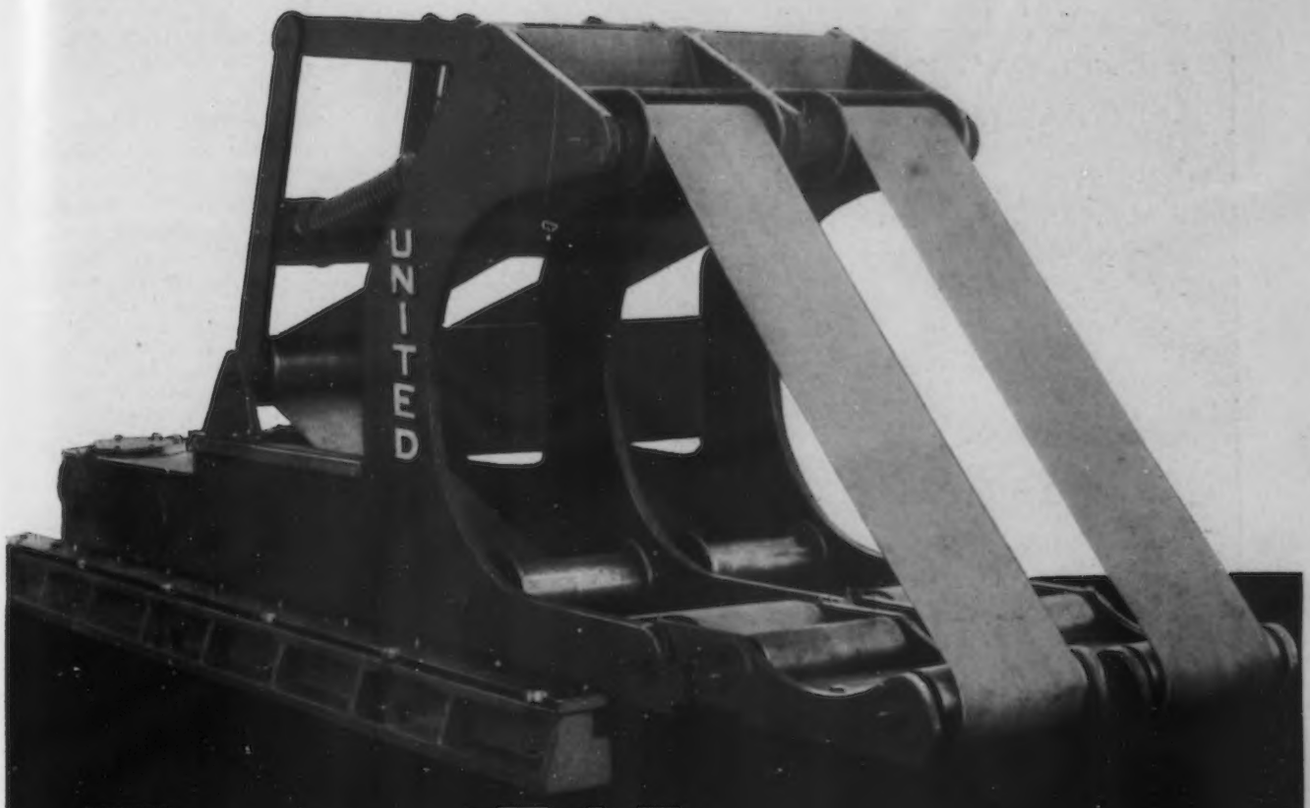
Many manufacturing organizations use micarta gears extensively, and Fig. 13 shows an operator cutting a gear blank from a 7½ in. thick piece of No. 262 micarta. This material is made from woven fabric base, is very tough and strong, and machines quite readily to as smooth a finish as most metals. Micarta gear material is made up 10 in. in thickness, and a gear or pinion up to a 10 in. face can be made from a single thickness of plate.

The cutting saw used on the machine in Fig. 13 is a standard 8-pitch carbon-steel band saw.

Micarta tubes are made by rolling paper treated on one side on an arbor, after the treated paper has been made plastic by passing over an electrically heated metal anvil. This tube is then pressed off the arbor and is finish ground on centerless grinder to manufacturing limits which are usually within plus or minus 0.002 in. The predetermined inside diameter can be held within plus or minus 0.002 in.

The drilling of drainage holes in a micarta rayon spinning bucket is shown in Fig. 14. Fifty-four holes of less than 1/10 in. diameter are drilled in 1½ min. These spinning buckets are used in the manufacture of rayon thread, and operate at a speed up to 8000 to 10,000 revolutions per min.

The drilling machine has three drill heads and three drills in each head, all of which operate in unison. When the operator starts up



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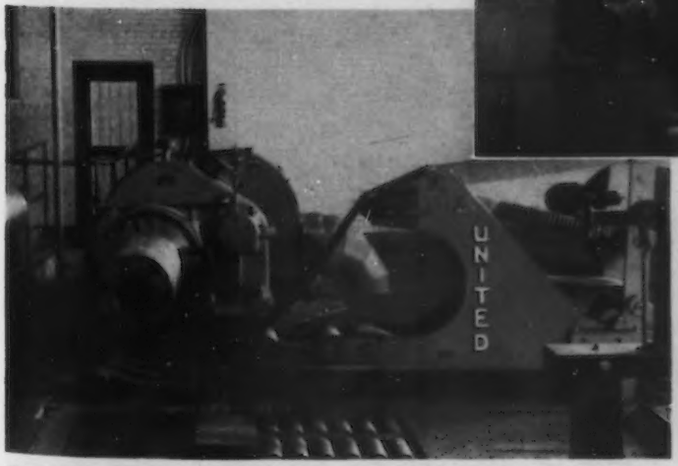
United Belt Wrappers are now operating successfully on 16," 20," 26" and 30" diameter tension reels for cold reduced strip products of tin plate and heavier gauges with resultant increases in tonnage up to 18%.



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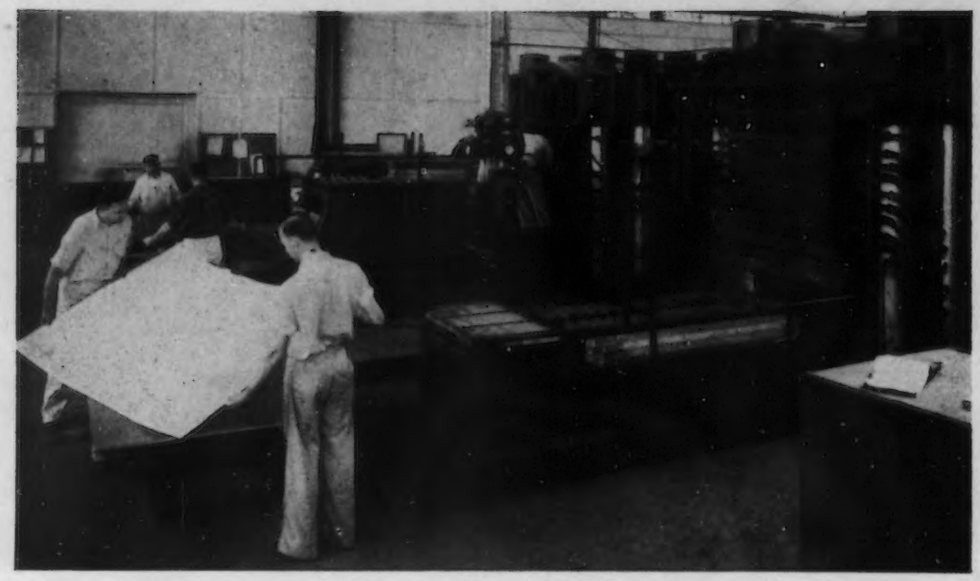

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FIG. 12—Presses used for processing laminated micarta plate, with a maximum measurement of 96x48 in.

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the machine, it will drill nine holes, then index six times drilling a like number of holes each time and finally stop at its original position.

Handling Large Equipment

The generator division of Westinghouse manufactures large power and propulsion equipment and heavy railroad type motors. The machine tools used for this work are varied in size, the larger ones being a 28-ft. boring mill, 14-ft. planer, 120-in. lathe, a floor mill mounted in a large surface plate having a boring or facing capacity of 40 ft., and large post mills and slotters, both portable and standard.

Large vertical frames and rotors for slow speed application, similar to generators made for Boulder Dam, are made in this department. The parts are assembled on a sur-

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Since we began manufacturing Murray Patented Wire Rope Safety Slings in 1921, not a single failure has ever been reported to us. Murray Safety Slings ten, twelve and fifteen years old are still used in many plants. We make them to meet your requirements.

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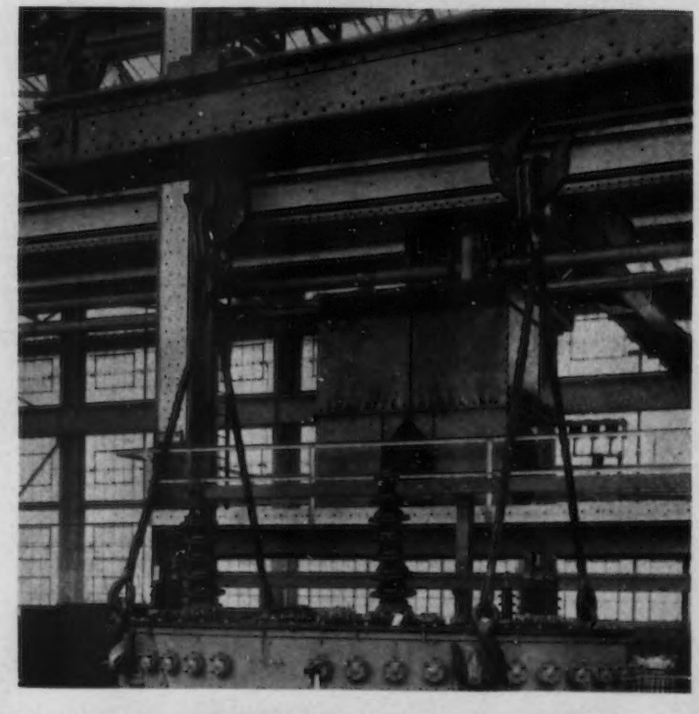

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The Murray Safety Slings illustrated here are lifting a load that requires two cranes and a specially constructed balance beam to handle. In your plant, for frequent light or heavy lifting, you will find that Murray Safety Slings prove satisfactory under every test.

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Whitney chains meet every requirement for dependable production drives. They offer smooth positive operation with high resistance to wear and maintenance costs reduced to a minimum. They offer short center drives with simple adjustment and the elimination of excess bearing pressure due to friction tension.

No other type of power transmission medium offers all the advantages of the chain drive. It will pay to investigate the design and performance possibilities of Whitney Chains on your own machinery or equipment. Write today for further information. The Whitney Chain & Mfg. Co., Dept. A-5 Hartford, Conn.

WHITNEY CHAIN DRIVES

FIG. 13—This standard eight-pitch carbon-steel band saw is cutting out micarta gear blanks.

face plate and machined on a floor mill, using portable millers, slotters and drilling machines to complete the necessary machining.

Turbo generators are machined and tested in the same department, as are large mill-type motors. Mill motors are manufactured up to 7000 hp. This larger size being used for steel mill drive in many cases. Frames of much of the large equipment, such as turbos, mill motors and generators, are manufactured from fabricated steel, the advantage in this type of construction being the light weight and less floor space required for the finished unit.

The fabricating department can roll steel to any desired radius, up to a maximum of 40 ft. wide and 9 in. thick, with other smaller rolls for thinner materials. The shaping and welding of this material, along with the necessary treatment to remove strains in the material, make an interesting study, on which an article of this general nature can only touch the high spots.

Turbo rotors, because of their high operating speed, are still made from forged steel.

Although railroad motors use cast steel frames yet, definite progress is being made to lighten construction and increase capacity. The frames require a variety of

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Sawing Sample Forgings

The Rockford Drop Forge Company prepare sample forgings by sawing them on their Doall Contour Machine. By this method they can quickly and inexpensively secure samples for testing and experiment. Intricate shapes and contours are easily handled with Doall's narrow precision saws and table tilt features.

DOALL Savings Important

Clean, precision cutting in material up to 8″ thick provides practical methods of saving in many fields of metal working. Time savings of 50% to 75% are usual—allowing not only better production but overcoming the shortage of skilled labor. With DOALL, the ordinary mechanic has the output of an expert one.

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Combination sawing—filing—polishing in one machine: Inexpensive maintenance because of low cost of saw blades; sturdy precision construction assuring long life and heavy duty; Exclusive Doall features widening the scope of contour machining.

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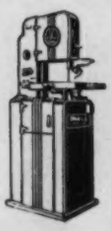

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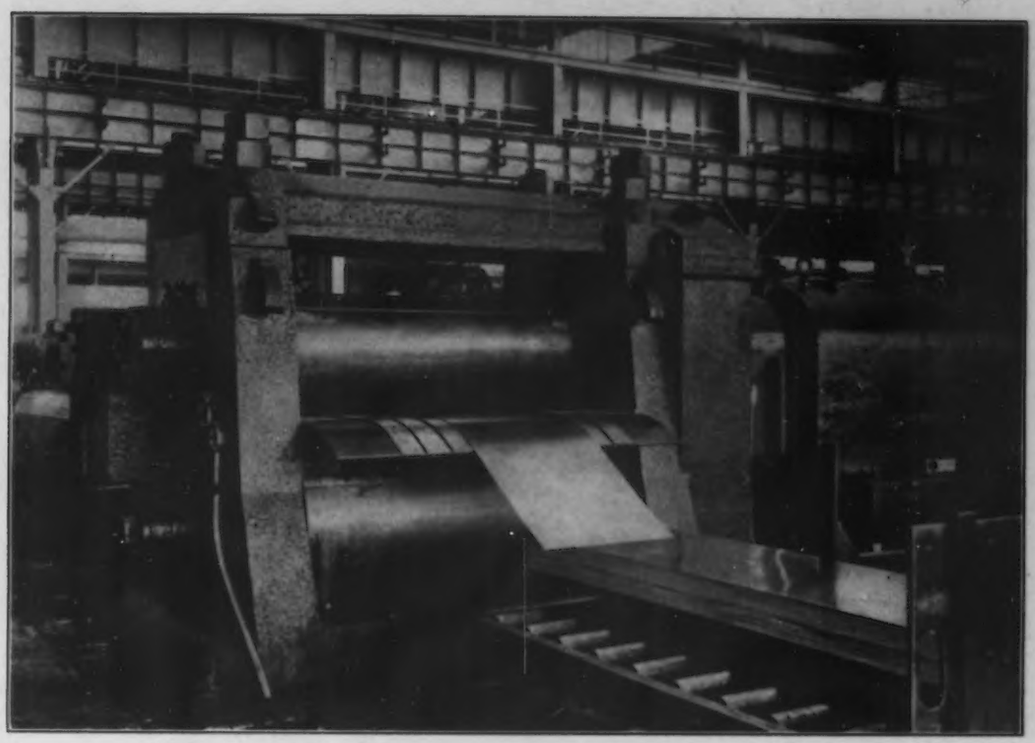

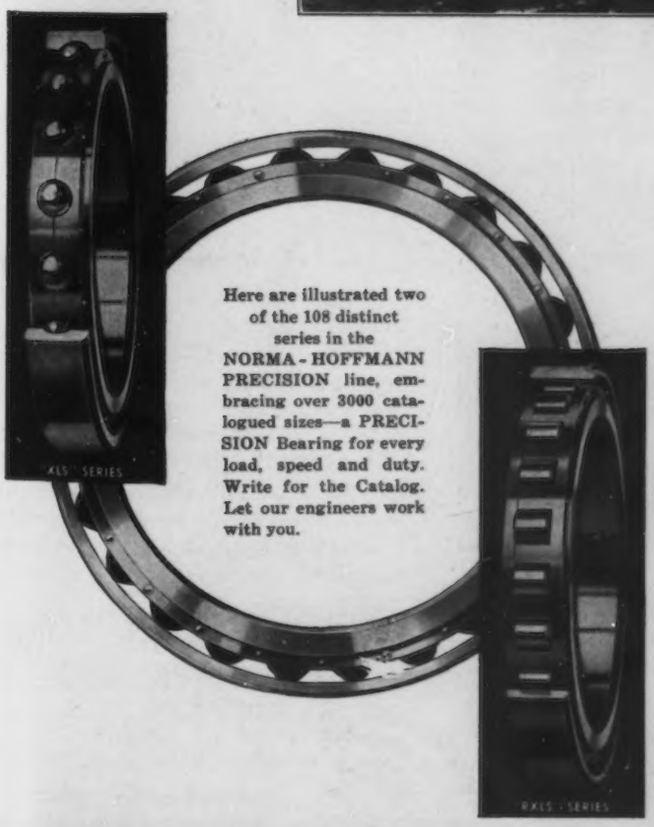

Here are illustrated two of the 108 distinct series in the NORMA-HOFFMANN PRECISION line, embracing over 3000 catalogued sizes—a PRECISION Bearing for every load, speed and duty. Write for the Catalog. Let our engineers work with you.

It was built by Mesta Machine Company, of Pittsburgh, for the Inland Steel Company and is a part of the 76-inch Continuous Strip Mill in the latter's Indiana Harbor plant. * * * * Engineers, designers, and builders of heavy-duty machinery recognize—in NORMA-HOFFMANN PRECISION BEARINGS—those rugged qualities which manifest themselves in extra-dependability, longer life, and lower maintenance costs.

BALL, ROLLER AND THRUST BEARINGS

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U.S.A.

machine tools in their manufacture, such as a 60-in. planer, planer-type miller, and horizontal-type boring mill, the latter usually with two boring bars, one for the axle bearings and the other for armature bearings.

After the frame is sized, several operations on draw-cut shapers, a key seater and drill presses are necessary. The holding fixture for drilling frames is worthy of note due to its unique arrangement, which is that the frame is set in a jig having two large wheels on either end which rotate on a track made from four rollers. This set-up enables a workman to turn the frame at will in order to drill all holes around its outside diameter. There are also arrangements made with plates located in fits on the fixture, which locate the necessary drilled holes. In some cases these plates are hinged to permit counterboring.

FIG. 14—This drilling machine automatically cuts 54 drainage holes in the micarta spinning bucket in 1½ min.

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Controls for motors of the foregoing type are manufactured in another department, as are other details which make up a complete motor or generator.

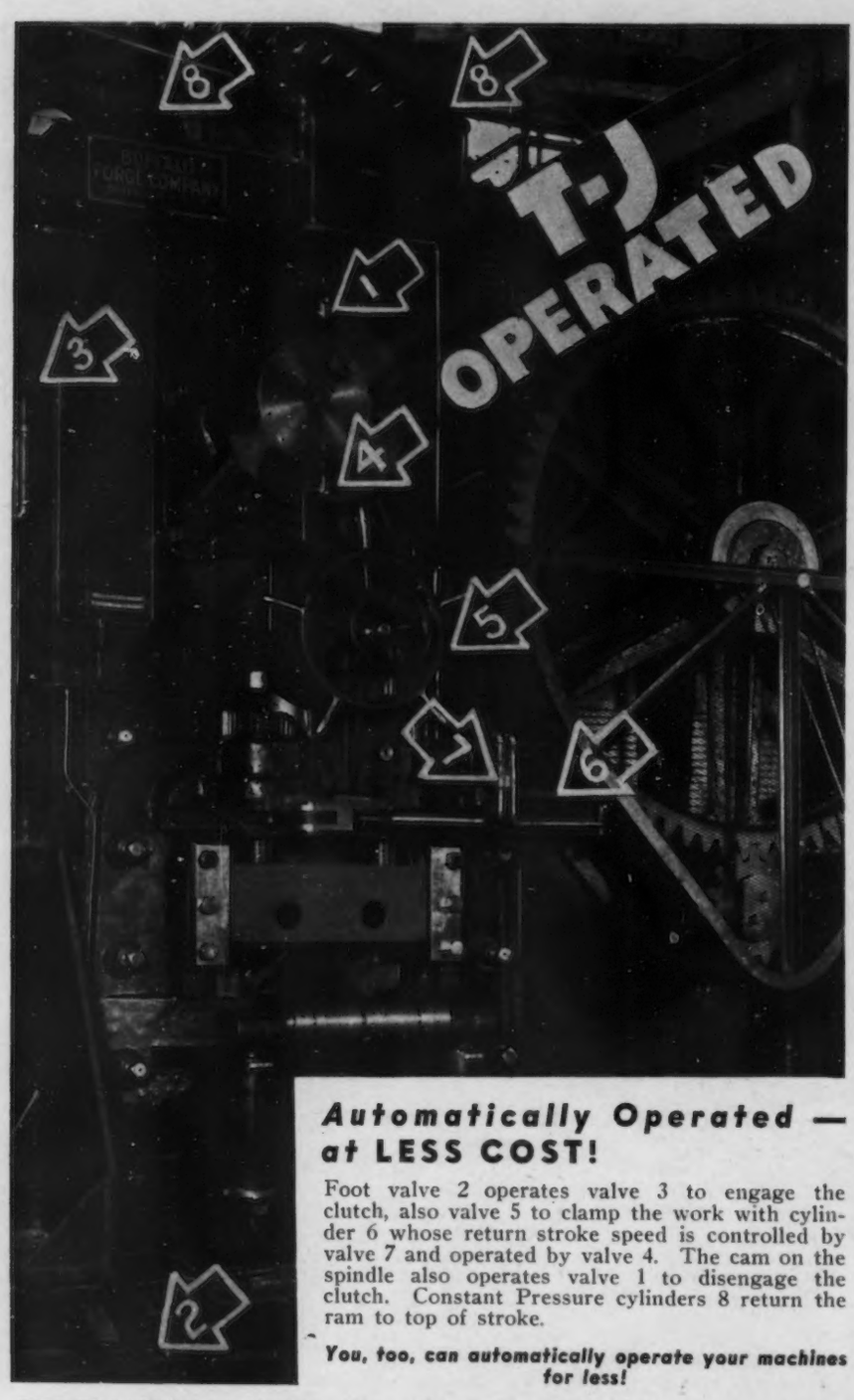
Definite progress has been made in reducing the cost of this equipment and at the same time to increase its capacity and life. The costs on generating equipment are high, due to the small quantities in which they are manufactured and the large number of set-ups required on machines.

Close Tolerance Required

Commutators and brushholders are manufactured on a variety of machines and for the most part require work to an extremely close tolerance. The commutator copper is cold drawn to the correct angle and size and the mica strip thickness is held to plus or minus 0.001 in., and all material is gaged under pressure in predetermined multiples to determine their correct size.

The bushing and spiders are machined on large hand operated turret lathes and vertical turret lathes according to their size.

Brush holders are manufactured from a hard alloy which gives long life, and the brush fits are held accurately. Most slotting is done on a high speed slotter with a tur-



Automatically Operated — at LESS COST!

Foot valve 2 operates valve 3 to engage the clutch, also valve 5 to clamp the work with cylinder 6 whose return stroke speed is controlled by valve 7 and operated by valve 4. The cam on the spindle also operates valve 1 to disengage the clutch. Constant Pressure cylinders 8 return the ram to top of stroke.

You, too, can automatically operate your machines for less!

THE TOMKINS-JOHNSON CO., 628 N. Mechanic St., Jackson, Mich.

FIG. 15—Motor shafts are turned on semi-automatic lathes with a series of tools set for the different diameters to be turned.

o o o

ret tool post on a ram, so a complete set of tools can be set up to complete slots without need for changing.

Insulating pins are given an electrical and pull test to determine if they were assembled correctly.

Automatic Equipment

Shafts are machined on heavy duty lathes arranged with front and back tool post. The tools are set to split the feed, so more feed can be used and deeper cuts taken if necessary. Tools working on both sides of the shaft help to balance it, thereby reducing spring to a minimum.

Shaft turning and spotting lathes are 24 in. and 27 in. swing and 10 ft. long between centers.

The manufacture of industrial motors is on a quantity set-up, with all related operations on frames, brackets, shafts and other details being machined on automatic equipment wherever possible. Certain features on some motors, such as coils for different types of applications and special shafts with extensions, are manufactured to specifications and combined with standard frames wherever possible.

Standard shafts are turned on a semi-automatic lathe with a series of tools set for the different diameters to be turned, and then a set of necking tools are moved in from the rear to spot the shafts for the grinding operation. Fig. 15 shows two machines set up on one type of shaft; the rear machine is set to rough the first end and the front machine is set to rough the second end and spot the shaft. These shafts are then finished on a cylindrical grinder, where the fits are first slab ground to 0.002 in. oversize and then traverse ground to size.

Keyways are milled on a machine arranged with a special fixture for holding six shafts, as shown in Fig. 16. The result being a very economical keyseating arrangement. The

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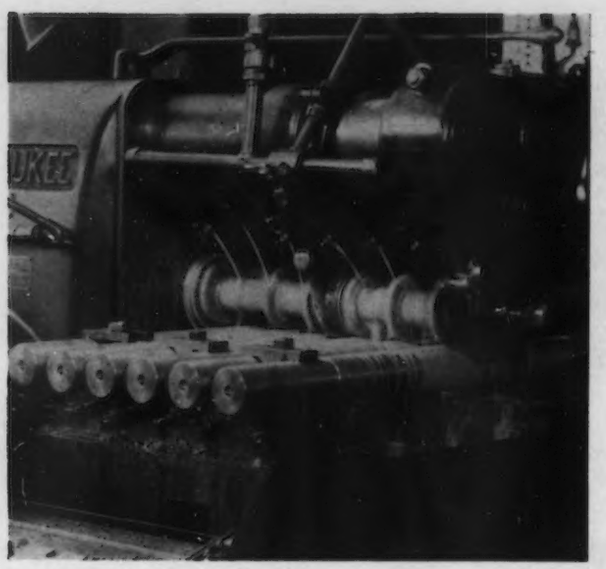

FIG. 16—A special fixture holds six shafts, all of which are having keyways milled simultaneously.

shafts are then polished on bearing fits and are ready for assembly.

Frames of medium-size motors are machined on an automatic turret lathe which bores, faces both sides and finishes the bracket fits at one setting. The operator then places them on a conveyor which moves them to a drill press set-up with multiple heads; one machine drills the bracket holes on both sides of the frame and the next machine drills the four holes in the feet. The next machine taps the bracket holes on both sides, and the frame is ready to have the stator pressed into place.

Constant speed a.c. rotors are assembled by an operator who

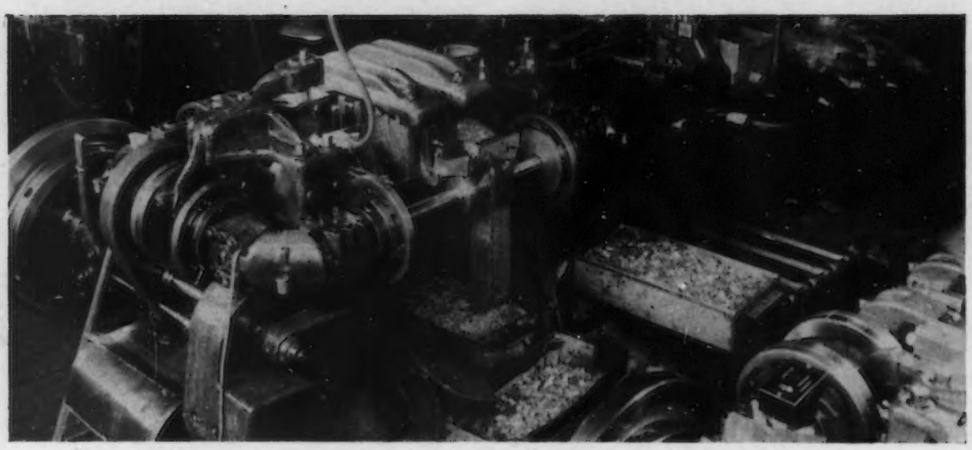

FIG. 17—A multiple-step punch press, which handles ribbon metal. Cams in the foreground and in the rear control a variety of punching operations.

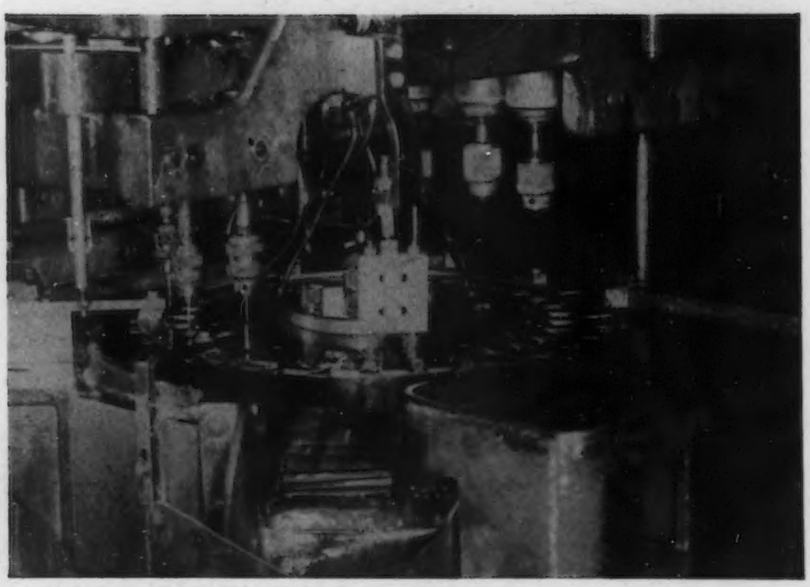

FIG. 18—An eight-spindle drill press used for drilling, burring and tapping. The dial rotates counter-clockwise, and indexing is automatic.

places the necessary number of laminated punchings in a fixture and presses them to the required thickness. The fixture is then placed in a die casting machine which casts the resistance rings, bars and fan blades all at one time. The rotor is then reamed and assembled on the shaft where it is turned.

Laminated punchings for the rotor and stator are made in three operations on punch presses. The first machine takes a round disk the size of the frame bore and punches the wire slots and inside bore. The second press receives the stator punching from the belt conveyor and punches the bore and outside diameter, after which the punched plate goes on a belt conveyor to the stacker. A third press receives

the center disk which had been punched from a stator punching, from another belt conveyor, and then punches the resistance bar slots and outside diameter of this plate to make the rotor punching. All these punchings are then stacked with keyways matched ready for building.

Unbalance Located Rapidly

After the armatures are assembled they are turned and conveyed to the dynamic balancing machine, which is an electrically operated (Stroboglow type) machine which is very fast and is able to place the amount and location of the unbalance very accurately.

Brackets are bored and faced, and the frame fit turned and reamed on an automatic machine in one setting. A conveyor then takes the brackets to the drill presses where a multiple head machine drills the attaching holes; oil holes are drilled on the next machine.

In the meter and instrument division, the machine tools are smaller than in the motor division, but the quantity of work handled runs to larger figures. It has been found that most jobs have special set-ups, and machines and tools are purchased to meet the requirements of each particular job.

Presses Mounted in Units

Fig. 17 shows a multiple-step punch press on which each step in the production of a part is under individual position control. In the right foreground of Fig. 17 is shown a shaft mounted horizontally, on which are mounted the cams, and in the rear there is a similar shaft carrying other cams. Each cam has a particular function in relation to the tooling which is contained within the body of the machine. Each position of a cam is in effect a complete punch press within itself, so that any process carried on within the range of this position is controllable within that position and constitutes what might be termed a multiple of presses. Each press is located so as to do its own particular part of the work, and the whole is mounted on a work frame making one unit.

At the extreme right of the machine is a stand containing the stock straightening rolls and the roll feed mechanism which feeds the stock a definite distance on each stroke. Coiled ribbon material is handled exclusively by this machine. Due to the long set-up time required, it has been found impractical to adjust this machine to handle quantities of less than 100,000.

Automatic screw machines play a big part in producing details in the Westinghouse plants, as for instance a five-spindle machine which is complete with threading attachment, and roller bearings on the work spindle and force feed lubrication, a special gear on the center shaft, a fifth cross slide attachment, and stationary head burring tools.

Fig. 18 shows an eight-spindle drill press used for drilling, burring and tapping details. The four spindles on the right are for drilling and the four on the left are reversing and used for tapping. The dial rotates continuously counter-clockwise, and as a new piece of work is indexed under the various spindles they automatically perform their operation; after all operations are complete, the piece is ejected from the dial. Production costs are very uniform from machines of this nature which have definite work feeds.

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High production creates only a portion of the Dieing Machine's operating economy, as major savings are obtainable due to the exceptionally long life of dies when used in the Dieing Machine. Scientific guiding at die bed plus perfect alignment in operation results in die life several times that obtainable in ordinary equipment.

Let our engineers furnish production estimate indicating production savings possible upon your stamped parts. There is no obligation.

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Speed up to 500 strokes per minute with progressive dies

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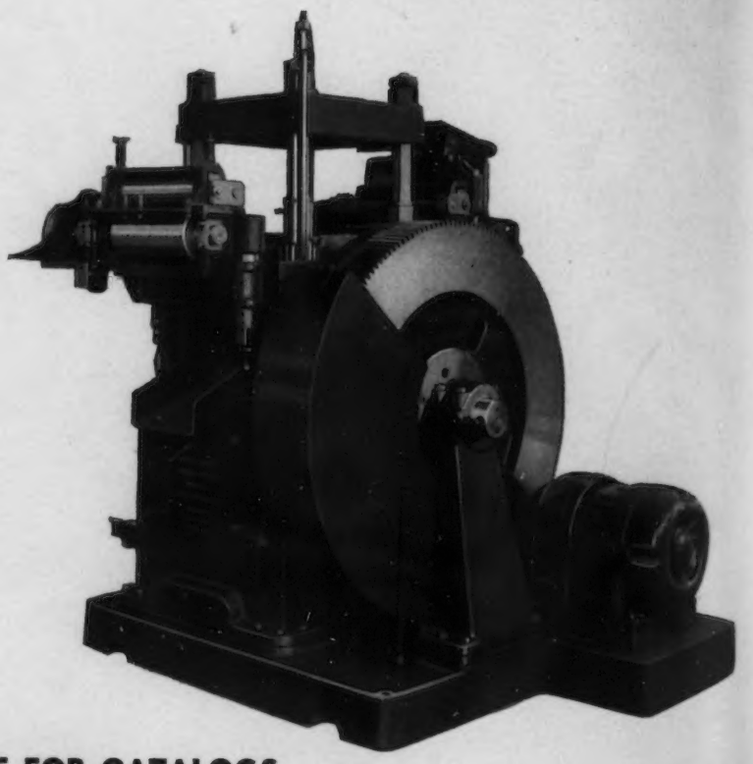

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For Steels and Steel Alloys

Norton "B-E" Bond Wheels

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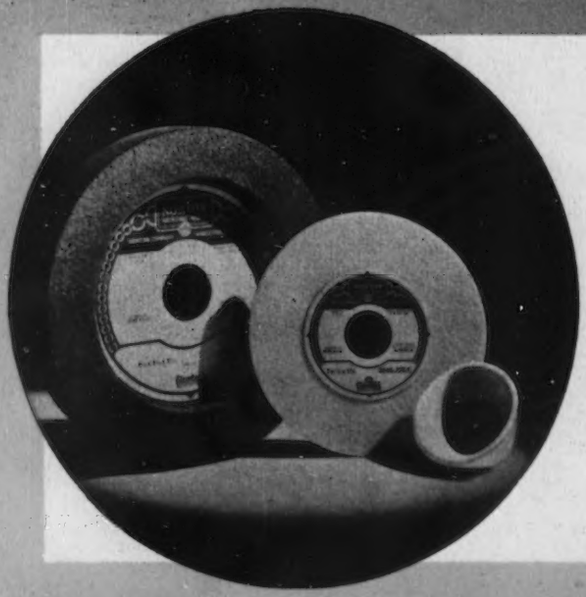

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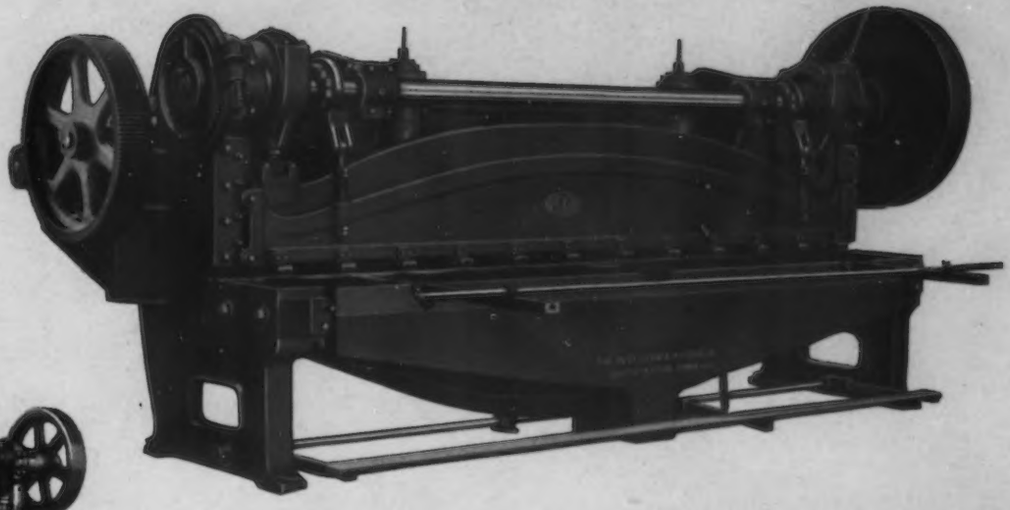

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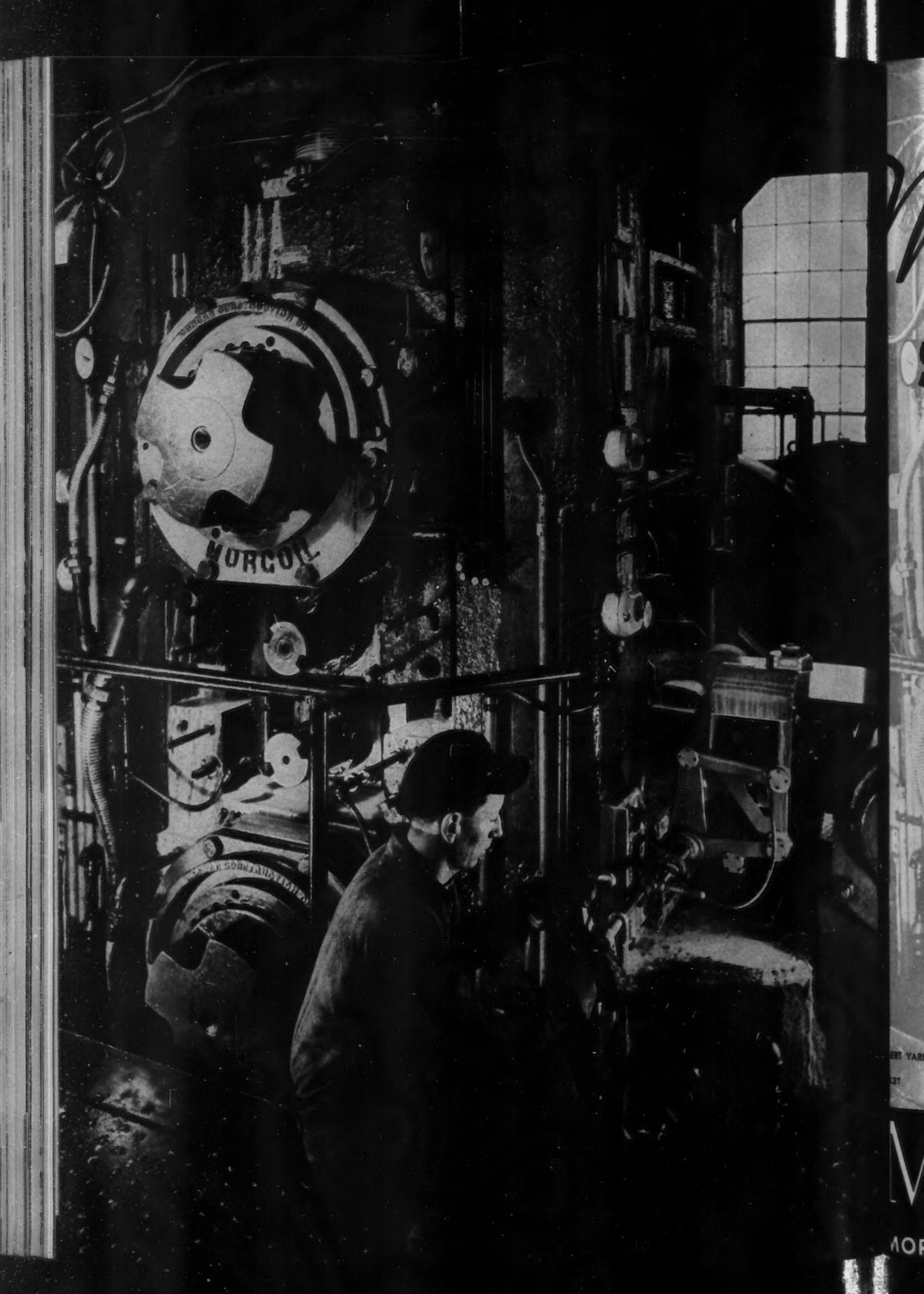
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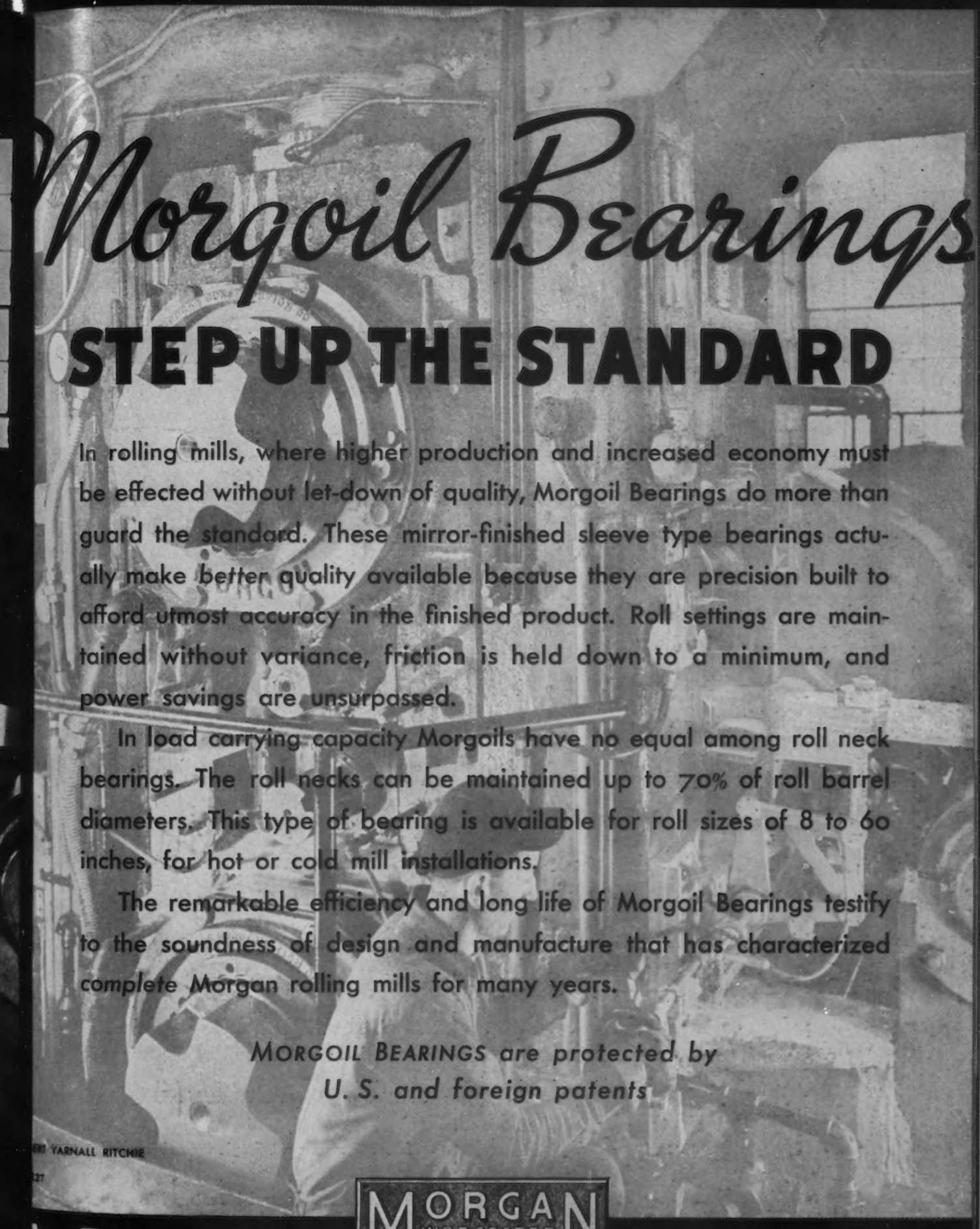


Morgoil Bearings

STEP UP THE STANDARD

In rolling mills, where higher production and increased economy must be effected without let-down of quality, Morgoil Bearings do more than guard the standard. These mirror-finished sleeve type bearings actually make better quality available because they are precision built to afford utmost accuracy in the finished product. Roll settings are maintained without variance, friction is held down to a minimum, and power savings are unsurpassed.

In load carrying capacity Morgoils have no equal among roll neck bearings. The roll necks can be maintained up to 70% of roll barrel diameters. This type of bearing is available for roll sizes of 8 to 60 inches, for hot or cold mill installations.

The remarkable efficiency and long life of Morgoil Bearings testify to the soundness of design and manufacture that has characterized complete Morgan rolling mills for many years.

MORGOIL BEARINGS are protected by U. S. and foreign patents

ERT YARNALL RITCHIE

27

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS

Morgoil Bearings

MORGAN CONSTRUCTION COMPANY · WORCESTER, MASS., U.S.A

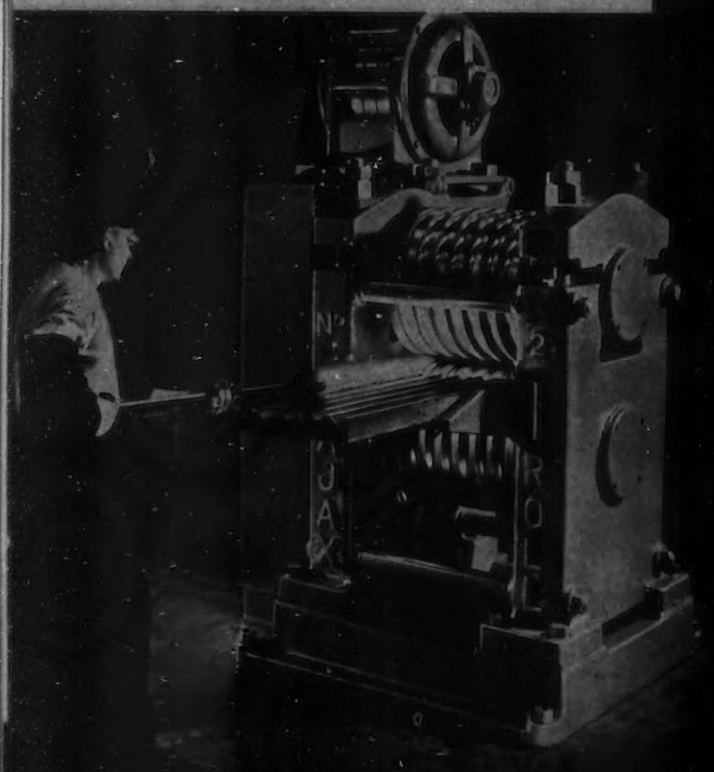
AJAX

FORGING ROLLS and FORGING PRESSES are ideal production combination

A recent advance in the forging field is the use of Ajax "Wide Adjustment" Forging Rolls for rolling minimum weight blanks for subsequent forging in an Ajax "Solid Frame" Forging Press. Substantial economies in manufacture are possible by this method, which utilizes the outstanding advantages of each machine, namely the ability of the rolls to effect rapid displacement of stock and the speed and accuracy of the press for forging.

The stock is first heated and rolled to the required shape with the metal distributed to properly fill the press die impressions. This pre-formed blank can then be forged in the press either at the same heat or after reheating, depending upon the forging, and can be hot coined to extreme accuracy.

The broad possibilities of this method present a most attractive field for future development. We will be glad to make a survey of your forging requirements from samples, blueprints, or by a visit of a qualified engineer to determine whether this method can be applied to advantage in your plant.



Other AJAX Machines

Continuous Motion Rivet Heading Machines

Slow Speed and High Speed Bulldozers

Hot Sawing and Burring Machines

Hot Pressed Nut Machines

Ajax-Hogue Wire Drawers

Reclaiming Rolls

AJAX

AIR CLUTCH FORGING MACHINES for high speed, accurate forging

In the period of increased business which lies ahead, the rewards of efficient manufacture will undoubtedly go to those who are prepared to meet the demands of a highly competitive market. Many progressive executives have already modernized their production equipment, replacing obsolete, profit-eating machinery with modern up-to-date machines designed to earn dividends through increased production, higher operating efficiency and improved product.

In the forging field, Ajax Air Clutch Forging Machines are consistently setting new production records on all types of upset forgings and in many cases are producing forgings of difficult shapes to an accuracy formerly believed impossible. These heavier, more powerful, faster machines, ranging in size from 1″ to 7″, are of the most advanced design ever offered to industry. An Ajax engineer will be glad to explain the benefits you can derive by modernizing your plant with these improved machines.

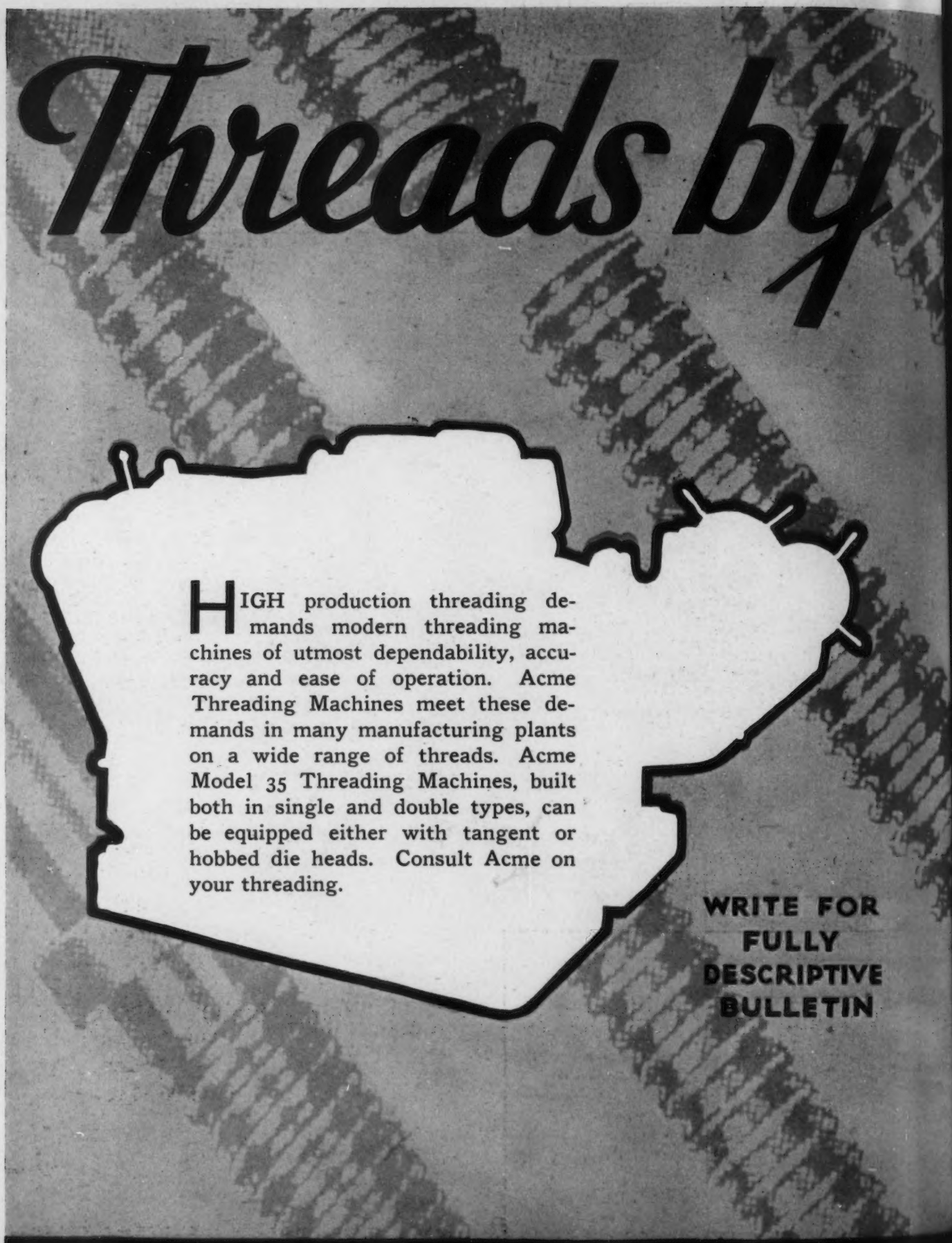
THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O.

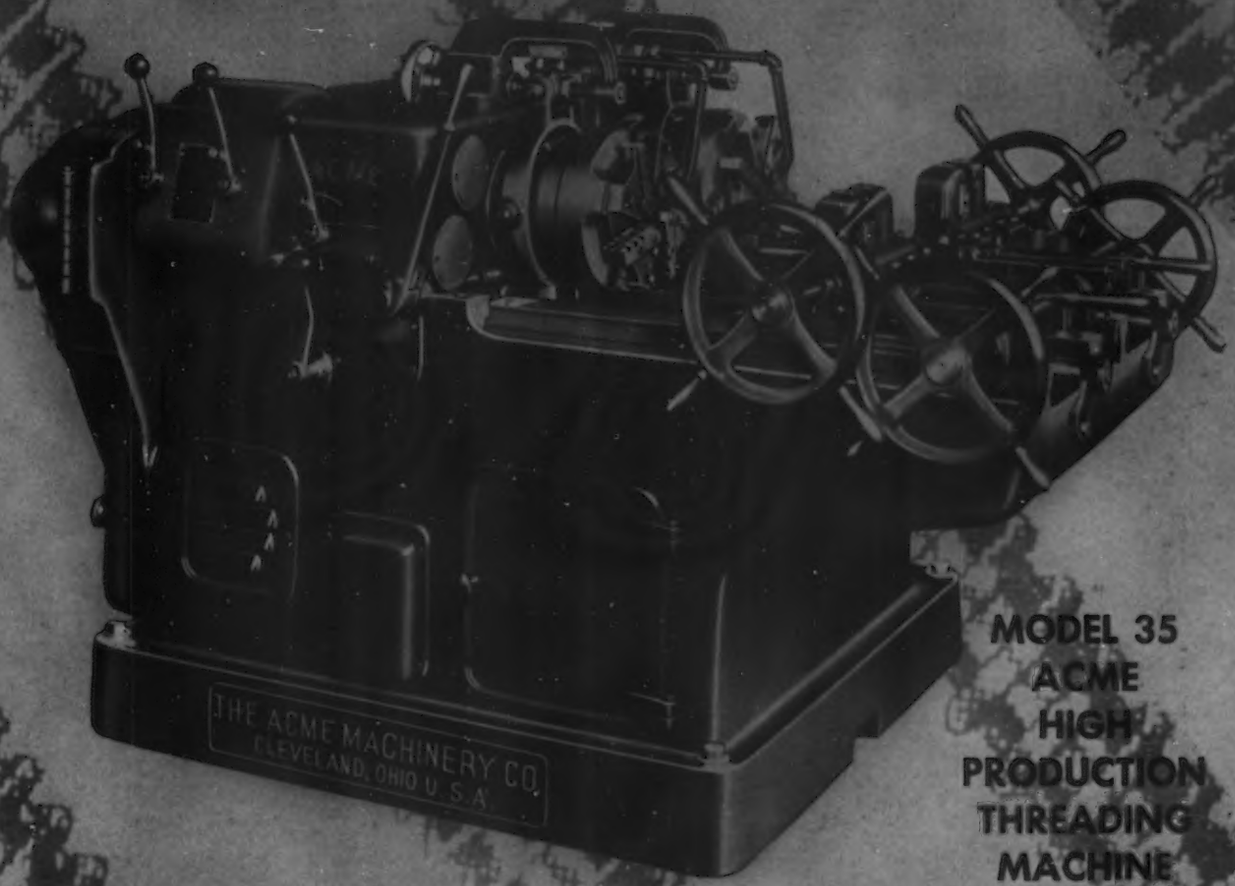
CLEVELAND, OHIO

621 MARQUETTE BLDG., CHICAGO, ILL.

301 DEWART BLDG., NEW LONDON, CONN.


Threads by
HIGH production threading demands modern threading machines of utmost dependability, accuracy and ease of operation. Acme Threading Machines meet these demands in many manufacturing plants on a wide range of threads. Acme Model 35 Threading Machines, built both in single and double types, can be equipped either with tangent or hobbed die heads. Consult Acme on your threading.
WRITE FOR FULLY DESCRIPTIVE BULLETIN
ACME THREADING MACHINES

ACME



MODEL 35
ACME
HIGH
PRODUCTION
THREADING
MACHINE
Equipped with
two heads
and carriages

THE ACME MACHINERY CO.
CLEVELAND, OHIO, U.S.A.

Servants of STEEL
Visit Space H-34 at the
National Metal Congress

... WHEELS BY CARBORUNDUM

The grinding wheels that are increasing production, improving quality and lowering operating costs throughout the metal working industry

BILLET Grinding . . . Roll Grinding . . . Snagging . . . All types of rough and precision grinding . . . Polishing. Every day on the production lines of great plants throughout the metal industry abrasives by Carborundum are proving they can increase production, improve quality, produce better finishes (where finish is a factor) and reduce costs. Visit the National Metal Congress and Exposition and see the complete line of Aloxite Brand Aluminum Oxide Wheels and Polishing Grains, and Carborundum Brand Silicon Carbide Wheels. "Carbofrax", the Carborundum Brand Silicon Carbide Super-Refractories for various high temperature installations in the metal working field, will also be on display.

CARBORUNDUM
REG. U.S. BRAND PAT. OFF.
ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N. Y.
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Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids
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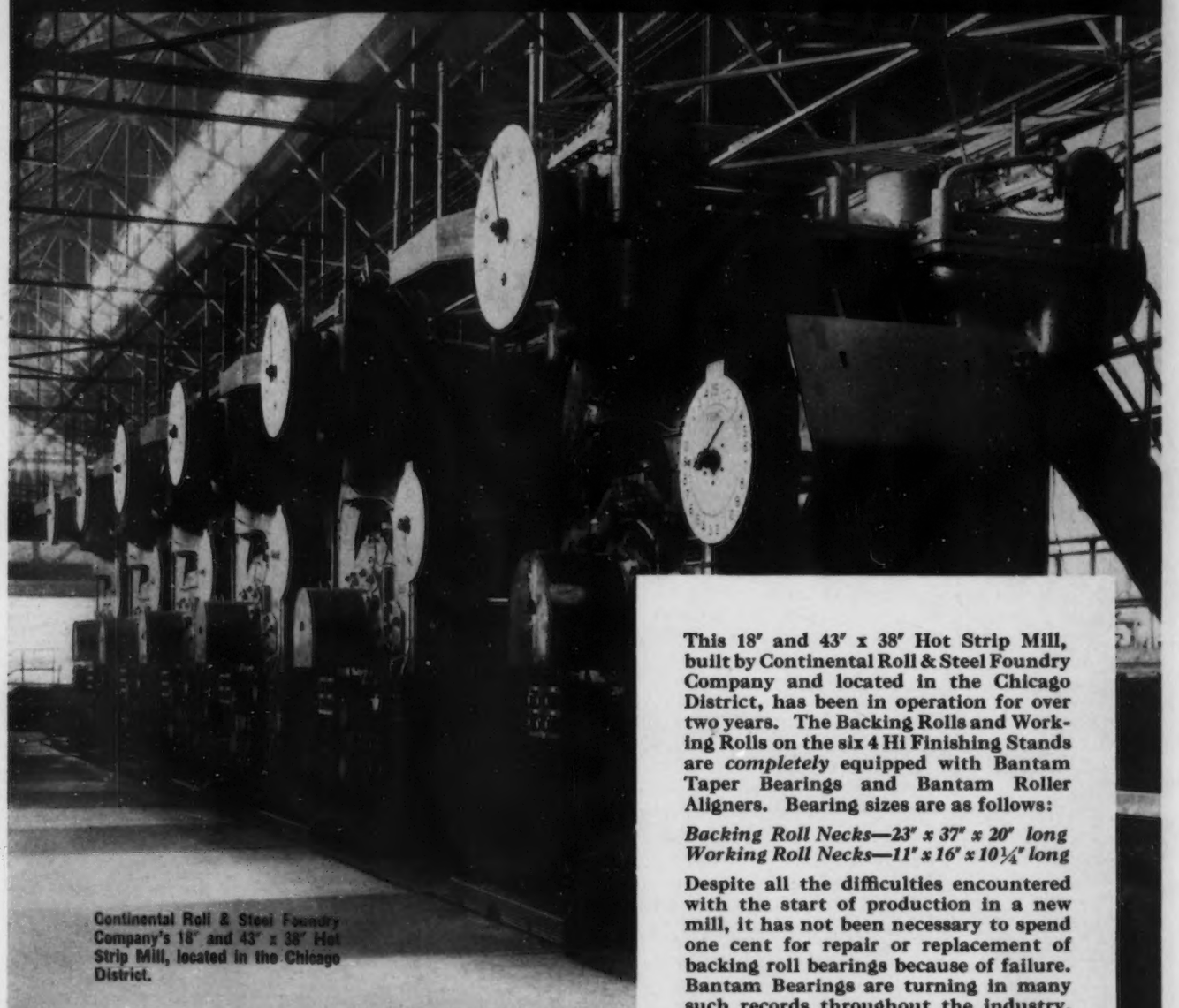
TWO YEARS OF OPERATION

Not One Cent Spent

ON BACKING ROLL BEARINGS



Continental Roll & Steel Foundry Company's 18" and 43" x 38" Hot Strip Mill, located in the Chicago District.

This 18" and 43" x 38" Hot Strip Mill, built by Continental Roll & Steel Foundry Company and located in the Chicago District, has been in operation for over two years. The Backing Rolls and Working Rolls on the six 4 Hi Finishing Stands are *completely* equipped with Bantam Taper Bearings and Bantam Roller Aligners. Bearing sizes are as follows:

Backing Roll Necks—23" x 37" x 20" long
Working Roll Necks—11" x 16" x 10¼" long

Despite all the difficulties encountered with the start of production in a new mill, it has not been necessary to spend one cent for repair or replacement of backing roll bearings because of failure. Bantam Bearings are turning in many such records throughout the industry. They can do as much for you. Next time specify Bantam.

BANTAM BEARINGS CORPORATION
SOUTH BEND - - - INDIANA
Subsidiary of
THE TORRINGTON CO.,
Torrington, Conn.

BANTAM
BEARINGS

TAPERED ROLLER • • • STRAIGHT ROLLER • • • BALL BEARINGS

MORE POWER ON THE TOUGH DRIVES

Battery of drop forges with 4,000 lb. drop hammers in a steel plant, completely equipped with Condor Compensated Belts. Sudden jerks and heavy loads make this an exceedingly hard drive.

Condor Compensated

PATENTED

TRADE MARK REGISTERED

The Low Tension Rubber Belt with Equalized Ply Stresses

IN every plant there are one or more drives that are unusually hard on belts. Drives such as the one shown above where sudden jerks, unusual stresses and strains, and heavy loads soon begin to cause belts to lose their pulling power.

Condor Compensated Belts are especially designed for these tough drives. Results from many field installations show that ply rupture, ply separation, and fastener wear have been reduced to a minimum by the exclusive compensated construction. Naturally, as a result, Condor Compensated lasts longer, performs better.

Built so that stresses and strains developed at the arc of contact—where the destructive work is done—are equalized, Condor Compensated Belts have 12 advantages* that increase belt life . . . keep maintenance costs and troubles at a minimum—even on the toughest drives.

Unretouched photographs of ordinary rubber belt and Condor Compensated Belt after operating an equal number of hours on the same type drive. Notice lower belt has no "broken back" and no fastener wear—it's Condor Compensated.

Condor PRODUCTS

Conveyor Belt
Transmission Belt
V-Belt
Hydraulic Hose
Steam Hose
Water Hose
Air Hose

Contractors Hose
Sand Blast Hose
Suction Hose
Fire Hose
Molded Rubber Goods
Rubber Lined Tanks
Rubber Covered Rolls

Chute Lining
Launder Lining
Industrial Brake Blocks and Linings

Abrasive Wheels—Rubber Bonded

*12 ADVANTAGES

1. Ruptures in outside ply eliminated.
2. Freedom from ply separation.
3. Longer fastener life.
4. Can be operated on smaller pulleys.
5. Less bearing, shafting and hanger troubles.
6. For heavy loads, plies may be increased with same pulleys.
7. Operation less affected by atmospheric conditions.
8. Higher overload capacity or margin of safety.
9. Less wear on pulley side.
10. Can be dressed without injury to belt.
11. High production efficiency.
12. Material reduction in belting costs.

Available also in Types F & B for drives where some slip is desirable

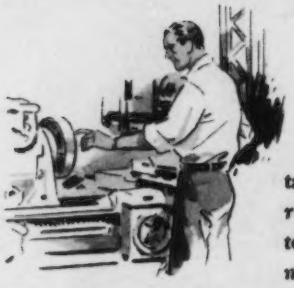
SOLD BY LEADING JOBBERS

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES AND FACTORIES: 57 TOWNSEND ST., PASSAIC, N. J.

after all...

IS MACHINERY A GOOD THING



ONE THING SURE, the world of today wasn't made by hand ... it was made by machinery. If we had fought this thing out just with our hands, the apes would have licked us long ago.

In the beginning the only animal in the jungle who had sense enough to seize and to use the materials and forces around him was Man. And with this one slight edge he has turned the rest of them into meat for his table, leather for his feet, and circuses for his amusement.

It PAYS to think! It pays to invent! It pays to seek the newer and better way! Don't ever do *anything* with your own two hands that you can do better with your BRAIN!

◆ ◆ ◆

We hear a lot these days about the *evils* of mechanization. Some say machines throw people out of work ... that, because of machines, millions are unemployed ... that we are being ground to death by the Frankenstein monster of steel which we, ourselves, have built.

If this is true, then we ought to get out our sledge hammers and smash all this machinery to pieces.

But before we wreck it, let's look at the facts ... is or is not machinery a good thing?

The job of machinery is to end drudgery, and it's making headway ... particularly here in America where there is less backache than anywhere else in the world. If you doubt it, just take a trip to Europe. Machinery does not enslave ... it emancipates! It doesn't empty pockets and stomachs and hearts ... it *fills them!*

It releases women from soapsuds and washtubs and makes better sweethearts, sisters, daughters, wives and mothers out of them. It has lifted the farmer off a horse and put him on a tractor. And, as for the shopman, it has taught him how to drill a thousand holes *right*, in less time than it used to take him to drill one hole *wrong* ... *and to get more money for it.*

"But how about the men that these drill-presses displace?" Don't say "displace" ... say "*promote.*" Machinery has lifted these men into better jobs. They themselves will tell you so. They'll go even further ... they'll tell you that, before machinery, anybody who would have dared to suggest a shorter day, a shorter hour week, and a bigger wage, would have been plain crazy.

The fact is that machinery has at last made it possible for the forgotten man to begin thinking in terms of daylight and fresh air and sunshine and LEISURE.

Is or is not that a bad thing?

Without machinery, there could be no volume. Without volume, things would cost more and they wouldn't be anything like as good. Without better goods for less money, only the favored *few* could have modern homes and live modern, full-lunged lives.

This means that without better goods for less money there could be no mass markets ... meaning no mass employment ... meaning PERMANENT DEPRESSION! Would we like to see THAT happen?

◆ ◆ ◆

No ... machinery is NOT a bad thing! It is the best of man-made GOOD things!

We are on our way ... marching onward and upward to the music of whirring wheels. And LINK-BELT is furnishing its share of the music.

In most machinery, today, LINK-BELT engineering and LINK-BELT manufacturing are playing an increasingly vital and important part.

7146A

LINK-BELT COMPANY

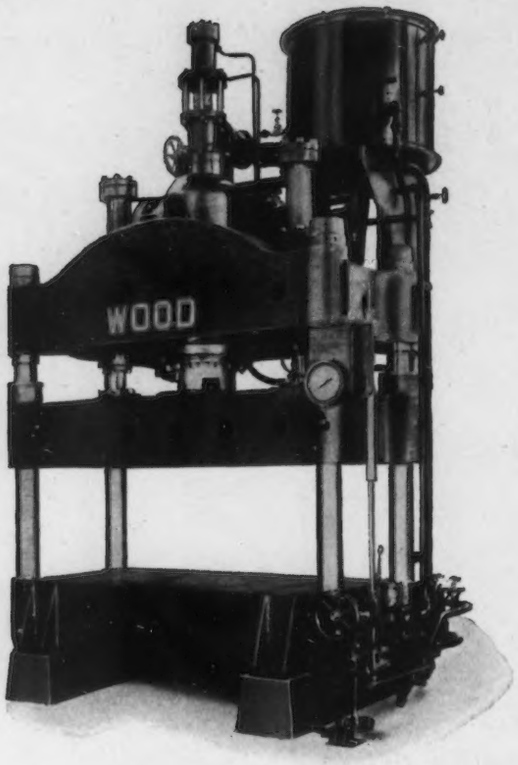
The Leading Manufacturer of Equipment for Handling Materials and Transmitting Power

INDIANAPOLIS • PHILADELPHIA • CHICAGO • ATLANTA
SAN FRANCISCO • TORONTO

"MAIN STREET... MY FOOT"
That's exactly what Bill Kaffrey said before he saw the book. Above you see Bill, comfortably seated at the general foreman's desk, reading rhymes about . . . of all things . . . lathes and getting a bookful of lathe "low-downs" that intrigued, surprized, fascinated Bill to ponder: "Why the---- hasn't someone talked about lathes like this before? . . . Bill may or may not have the final say about company purchases . . . but he knows his lathes outside-in and inside-out. Even hard-boiled Bill admits that "What Makes Main Street," not only gave him a better conception of his job . . . but an entirely new "lathe's-eye" view of his own particular niche in the parade of production.
"What Makes Main Street" . . . isn't written for just the Bills of the production line. It's written for everybody from the boss to the apprentice. It's a shop book for shop-minded men who spell PROFIT—p-e-r-f-o-r-m-a-n-c-e. An interesting book . . . a colorful book . . . a downright valuable book. You get a copy, via the coupon, for a quarter of a dollar. It's worth it.
The R. K. LeBlond Machine Tool Co.
Cincinnati, Ohio. Dept. L-1
Here's my quarter . . . send the book.
Name
Address (or Co.)
City
State
What makes Main Street?
Le Blond · Cincinnati, Ohio, U.S.A.

DIFFICULT PRESSWORK

Made Easy



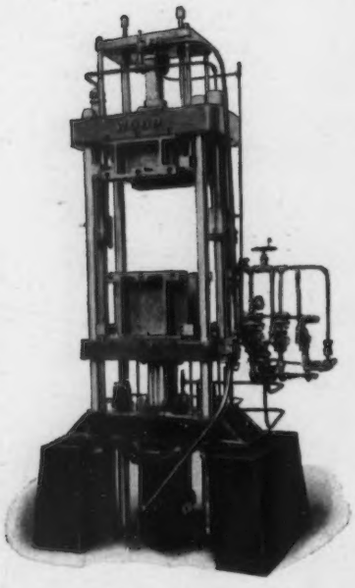
HydroLectric metal-forming press for airplane parts.

●

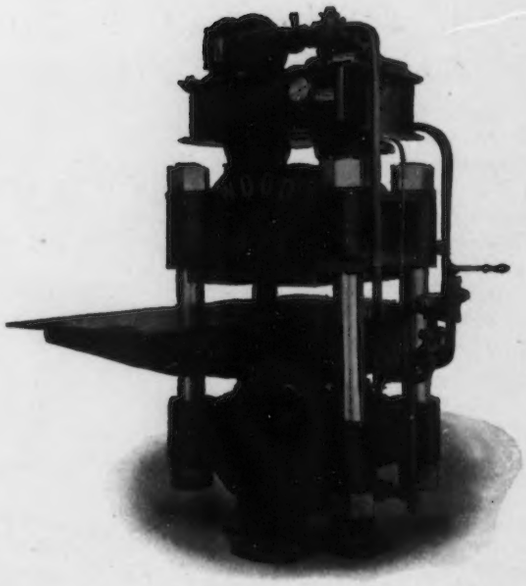
Wood hydraulic and HydroLectric presses have the extra precision, simplicity, speed, and sturdiness which mean higher production-schedules with fewer rejects. They have an outstanding record in working metal, rubber, fibre and plastics, and in extremely specialized press operations of every nature.

●

An engineering staff fully competent to design the most efficient machinery for your particular production problem, and modern shops whose origins reach almost to the beginning of the hydraulic press industry, are yours to command. Please write us concerning any specific problem.



Semi-automatic molding press for the plastic industry.



HydroLectric matrix press for the printing industry.

Die-sinking or grinding-wheel forming press.

R. D. WOOD CO.

400 CHESTNUT ST., PHILADELPHIA, PA.

ELPING GOOD MECHANICS DO BETTER WORK

BY THE DEVELOPMENT OF 2 NEW TOOLS FOR SPECIAL TYPES OF JOBS

FOR drilling in awkward places—there's nothing like the new Black & Decker ¼-Inch Shorty Drill. Shorty requires only 4½" clearance—its right-angle drive will reach "around corners"—and it has the same speed and power as a conventional ¼-Inch Drill.

The new ¼-Inch Low Speed Drill is specially designed for drilling in stainless steel, monel metal, high carbon and case-hardened steel. Its slower speed (450 r.p.m.) makes drilling easier, prevents burned drill bits and lost production time. Ask your Black & Decker Jobber to demonstrate these two new time-saving and money-saving tools—or write for complete details. The Black & Decker Mfg. Co., 751 Pennsylvania Avenue, Towson, Maryland.

Black & Decker

World's Largest Manufacturer of

BLACK & DECKER

PORTABLE ELECTRIC TOOLS

Straighten . . .
and Uncoil Automatically

Even Your Heaviest Coils
with
U. S. Tool Coil Cradles and Power Driven Straighteners

Today's trend is to coiled stock for economy . . . Heavy duty U. S. Tool Power Driven Straighteners and Coil Cradles enable you to adopt coiled stock even where truly flat blanks are specified. U. S. Tool Power Driven Straighteners will flatten your coiled stock equal to commercially flattened short strip. Savings in cost of stock, reduction of scrap, and productive labor will pay for these units in an amazingly short time.

The Straightener and Coil Cradle, illustrated, handle coiled steel 12" wide, up to 1/4" thick. Coils weighing up to 3 tons. Send us details of your stock so that our engineers may recommend the proper equipment.

Send for Bulletin 12

U. S. TOOL COMPANY, Inc., Ampere, East Orange, N. J.

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

POUGHKEEPSIE, N. Y.

Detroit Sales Office: 2608 Book Tower • Chicago Sales Office: 120 N. Peoria 5

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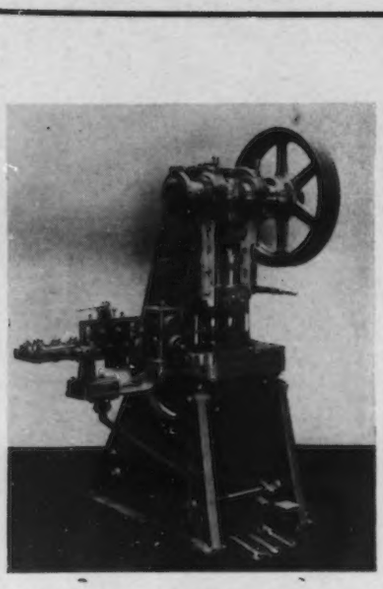
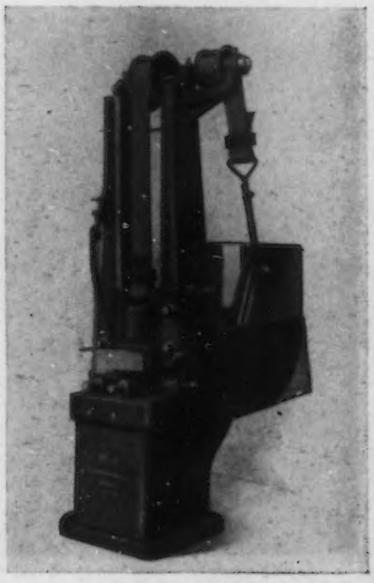


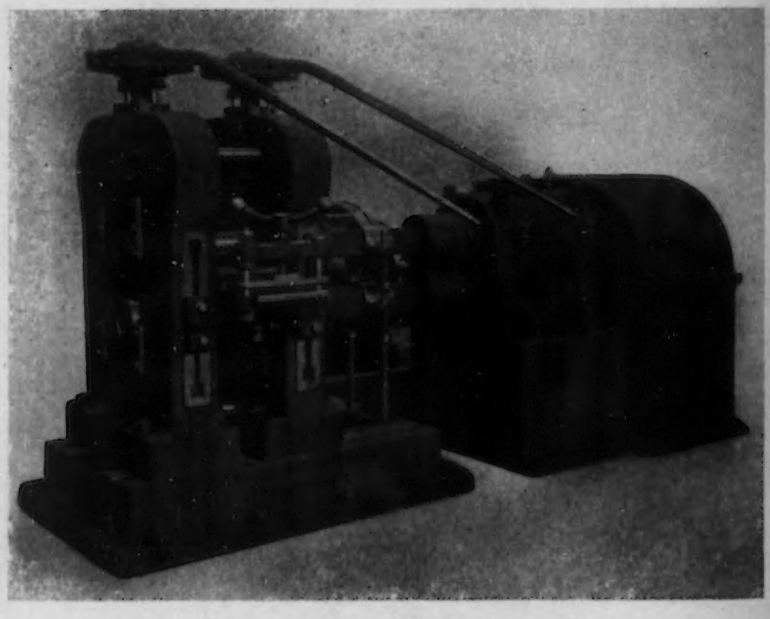
No. 8-S Press with Roll Feed and Stock Straightener

Rolling Mills
Power Presses
Drop Hammers
Swaging Machines

Roller Bearings
Turks Heads
Draw Benches
Special Machinery



No. 5 Automatic Drop Hammer with Crank Guard and Safety Device



10" Cold Strip Mill

STANDARD MACHINERY CO.

PROVIDENCE, R. I.

HYSPEED MEANS HIGH PRODUCTION

The increasing tempo of business demands ever greater quantities . . . higher quality . . . further economies . . . in production.

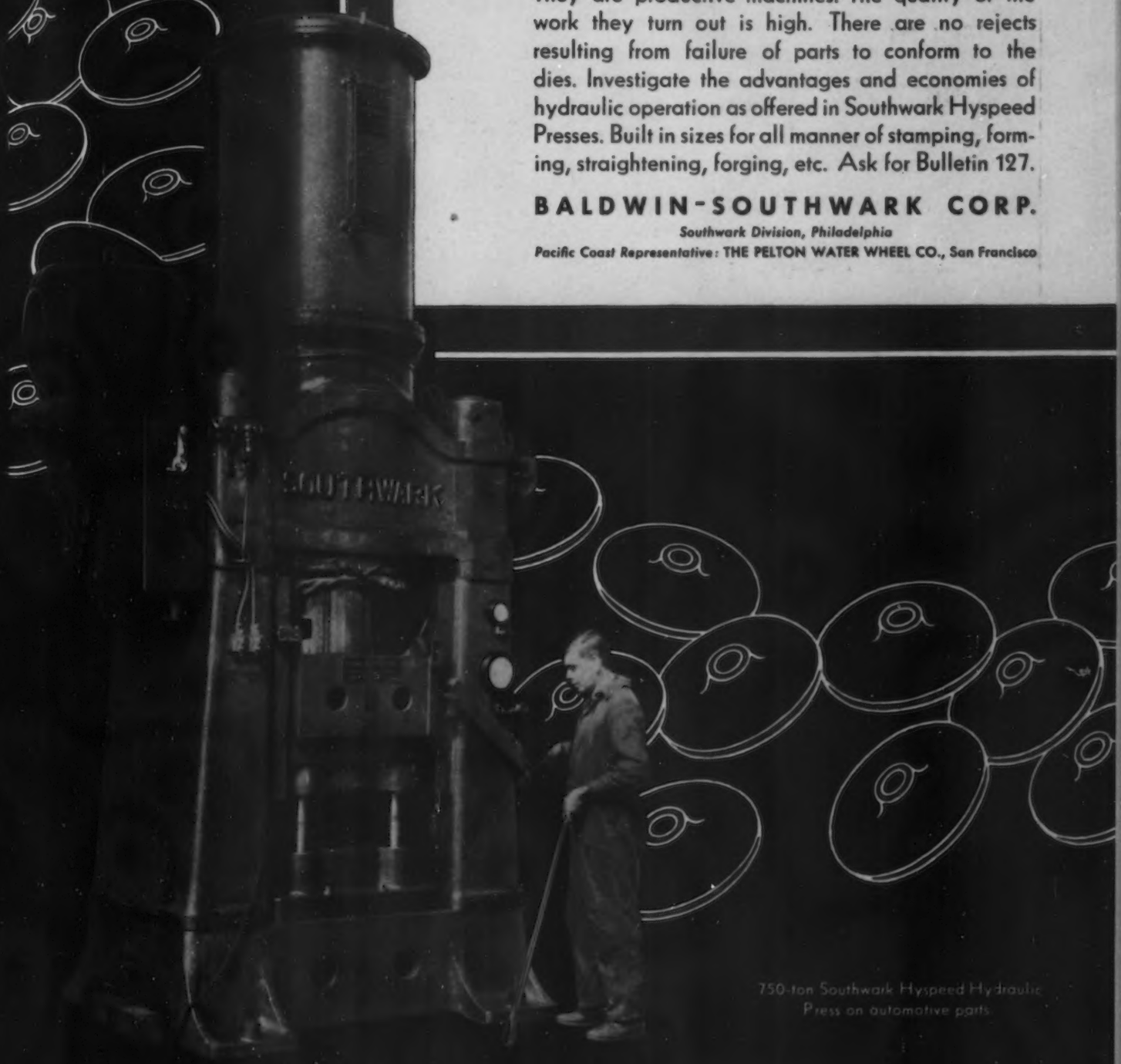
Southwark Hyspeed Hydraulic Presses are built to hold today's pace... to meet and surpass quality demands.

They are productive machines. The quality of the work they turn out is high. There are no rejects resulting from failure of parts to conform to the dies. Investigate the advantages and economies of hydraulic operation as offered in Southwark Hyspeed Presses. Built in sizes for all manner of stamping, forming, straightening, forging, etc. Ask for Bulletin 127.

BALDWIN-SOUTHWARK CORP.

Southwark Division, Philadelphia

Pacific Coast Representative: THE PELTON WATER WHEEL CO., San Francisco



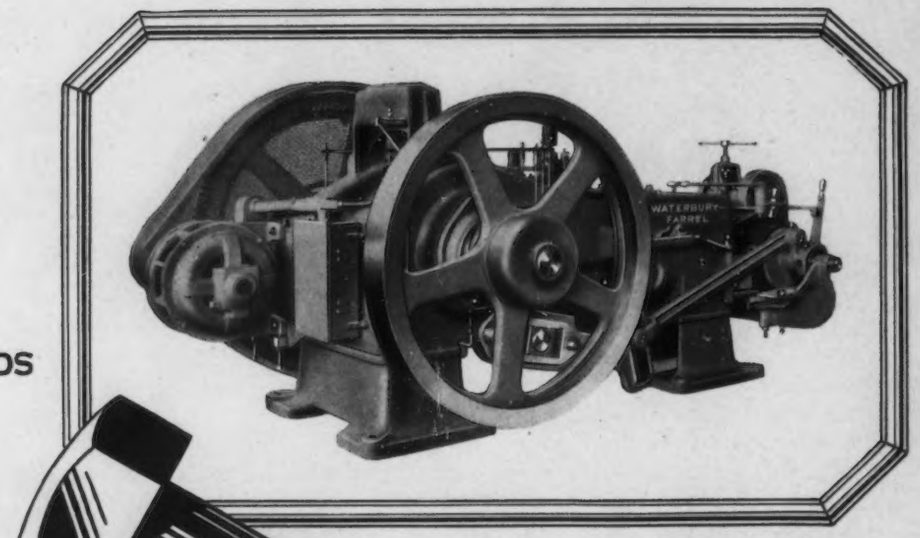
750-ton Southwark Hyspeed Hydraulic Press on automotive parts

SOUTHWARK HYSPEED PRESSES

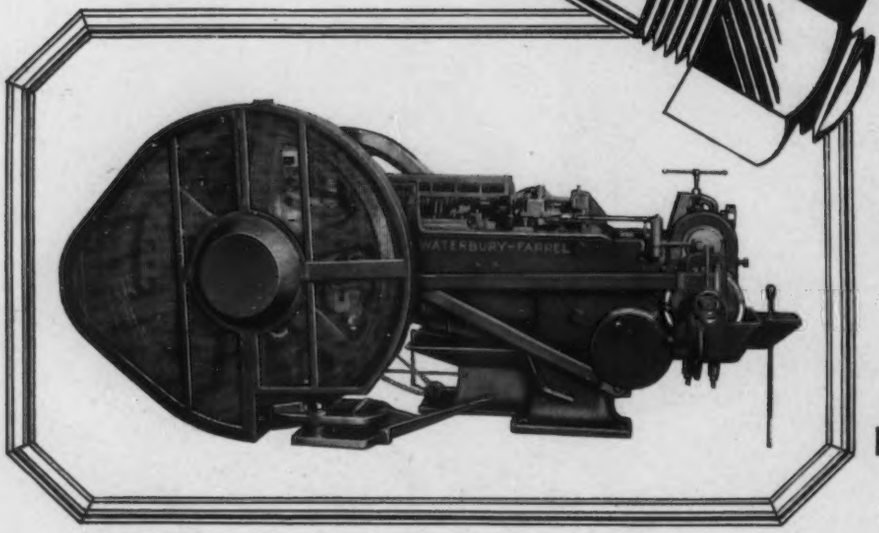
BOLT AND NUT MACHINERY

Cold Process Machinery for the Automatic Production of.....

BOLTS
SCREWS
NUTS
RIVETS
HEADED RODS
SPOKES
BALLS, ETC.



½-inch Open Die Double Stroke Crank Header with geared motor drive. This machine is rated at 70 to 80 headed blanks per minute. Weight 26,875 lbs.



HEADERS
TRIMMERS
POINTERS
THREADERS
SLOTTERS
NUT MACHINES
RIVET DRILLERS
ETC.

½-inch Automatic Nut Forming Machine with geared motor drive. Makes double chamfered nut blanks from cold drawn wire, 80 per minute. Weight 37,300 lbs.

WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

Home Office and Works:
Bank and Meadow Sts., Waterbury, Conn.

Sales Offices:
Cleveland, Chicago, Newark, N. J.

4 Questions

•Three for your Screw Shop Foreman;
• One for yourself

ASK YOUR FOREMAN:

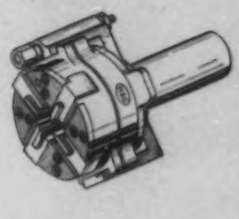
Would you like a die head so efficient that it always permits using new chasers—one where a dull set of chasers could be replaced by a new set with almost no adjustments and only a few minutes down time?

Would you like to use chasers that cost only a fraction of the price of other chasers and yet will usually run two or three times as long as the conventional chaser before getting dull and which can be inexpensively reground many times if desirable?

Would you like a die head that makes it possible to use the same chasers on many different sizes and types of machines?

Example: The same chasers on No. 0 and No. 2 Brown & Sharpe; * Davenport; 9/16 in., ⅞ in., or 1¼ in. Gridley; ⅞ in. or 1¼ in. Cone; ⅞ in., 1 in., 1¼ in. or 1⅜ in. New Britain, on different sizes of turret lathes, threading machines, etc., etc.

STYLE DM
for B4S Automatics and other small single spindles.

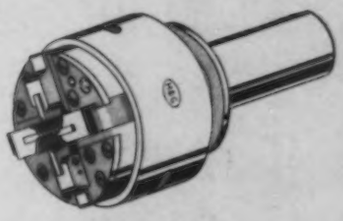


THEN ASK YOURSELF:

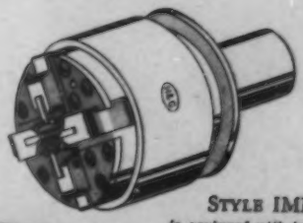
Would I like to reduce and simplify my chaser inventory, reduce my chaser cost per thousand pieces and reduce down time on threading jobs?

The H & G Insert Chaser Die Head provides all of these desirable features which may be summed up in the following five words—"SIMPLIFIED THREADING AT LOWER COSTS."

STYLE MM
for rotary spindles.



WRITE FOR LITERATURE.



STYLE IMM
is equipped with improved internal trip for shoulder threading such as for spark plugs.

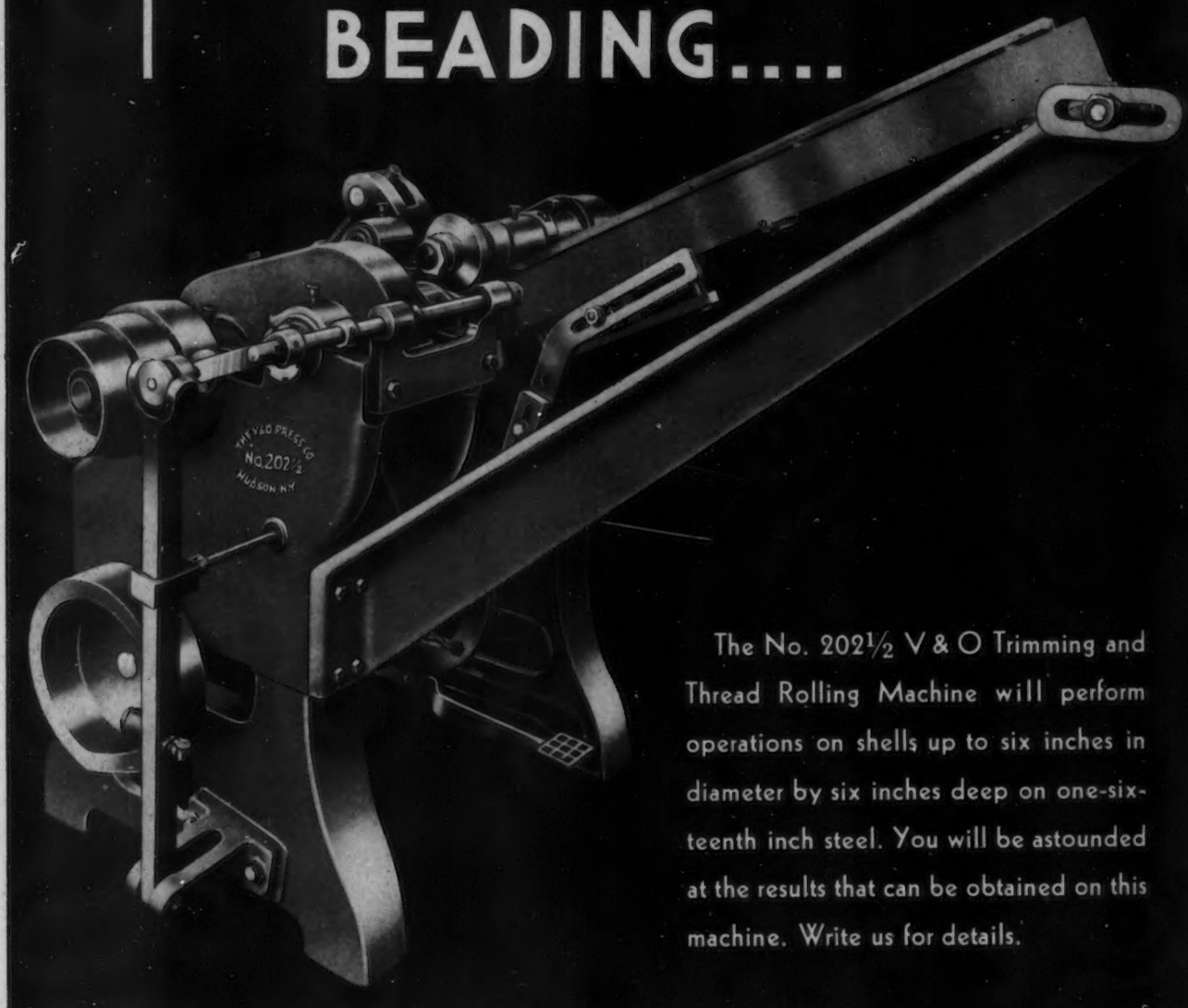
* *There is a No. 00 size of head for the No. 00 Brown & Sharpe using smaller chasers but which easily threads up to ⅜ in. diameter and which will show some astounding results as to quality of threads and economy of operation.*

THE EASTERN MACHINE SCREW CORPORATION
21-41 Barclay St., New Haven, Conn.

STYLE MS
for hand turret machines.

STYLE TM
has receding chasers for cutting superior quality taper threads.

for TRIMMING THREADING BEADING....



The No. 202½ V & O Trimming and Thread Rolling Machine will perform operations on shells up to six inches in diameter by six inches deep on one-sixteenth inch steel. You will be astounded at the results that can be obtained on this machine. Write us for details.

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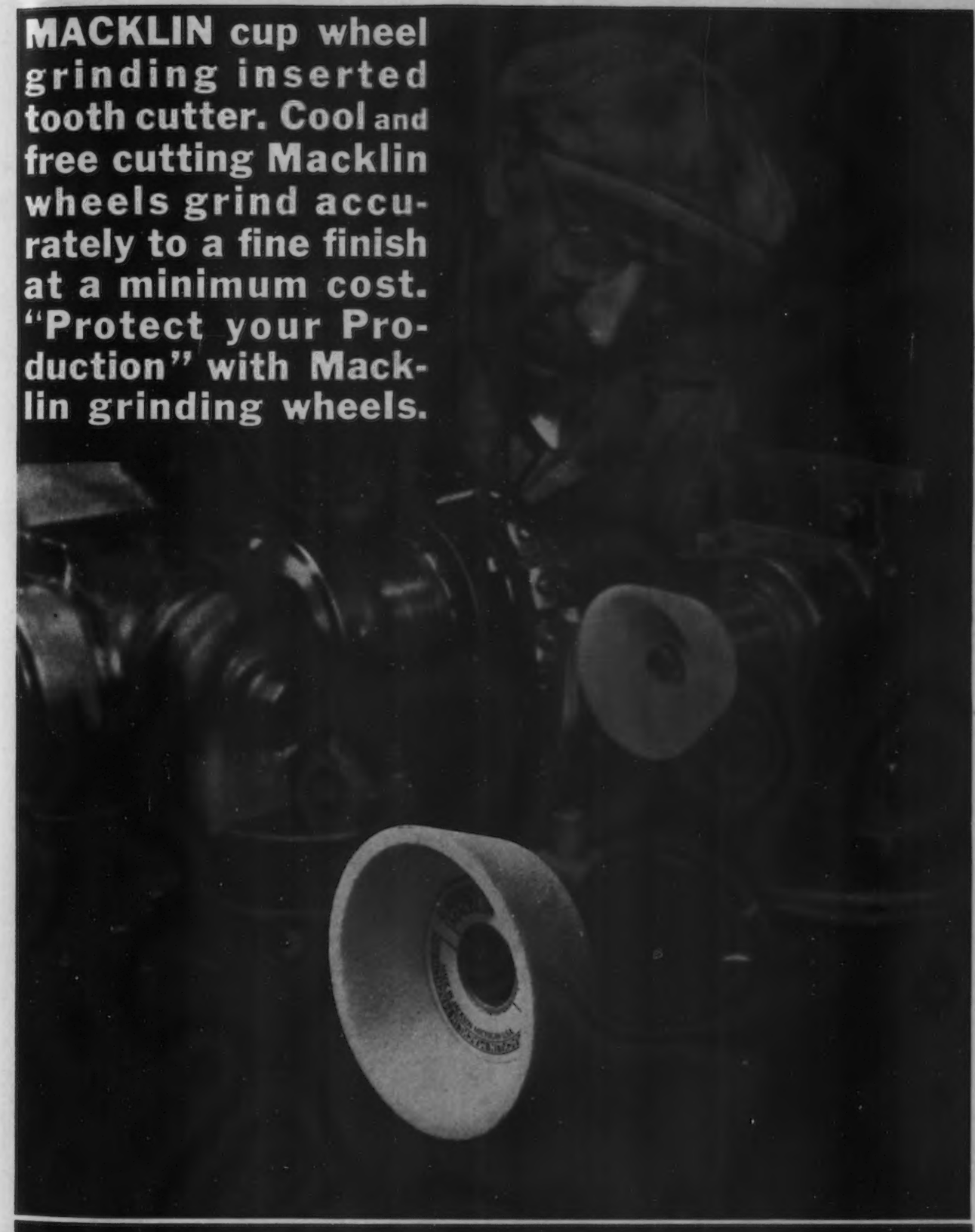

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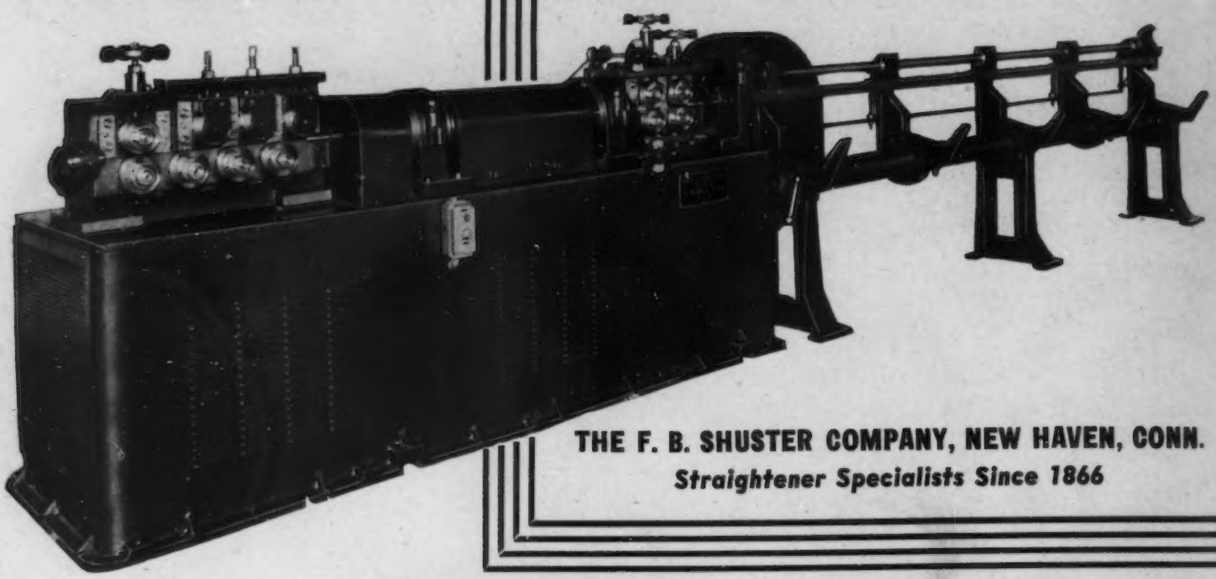

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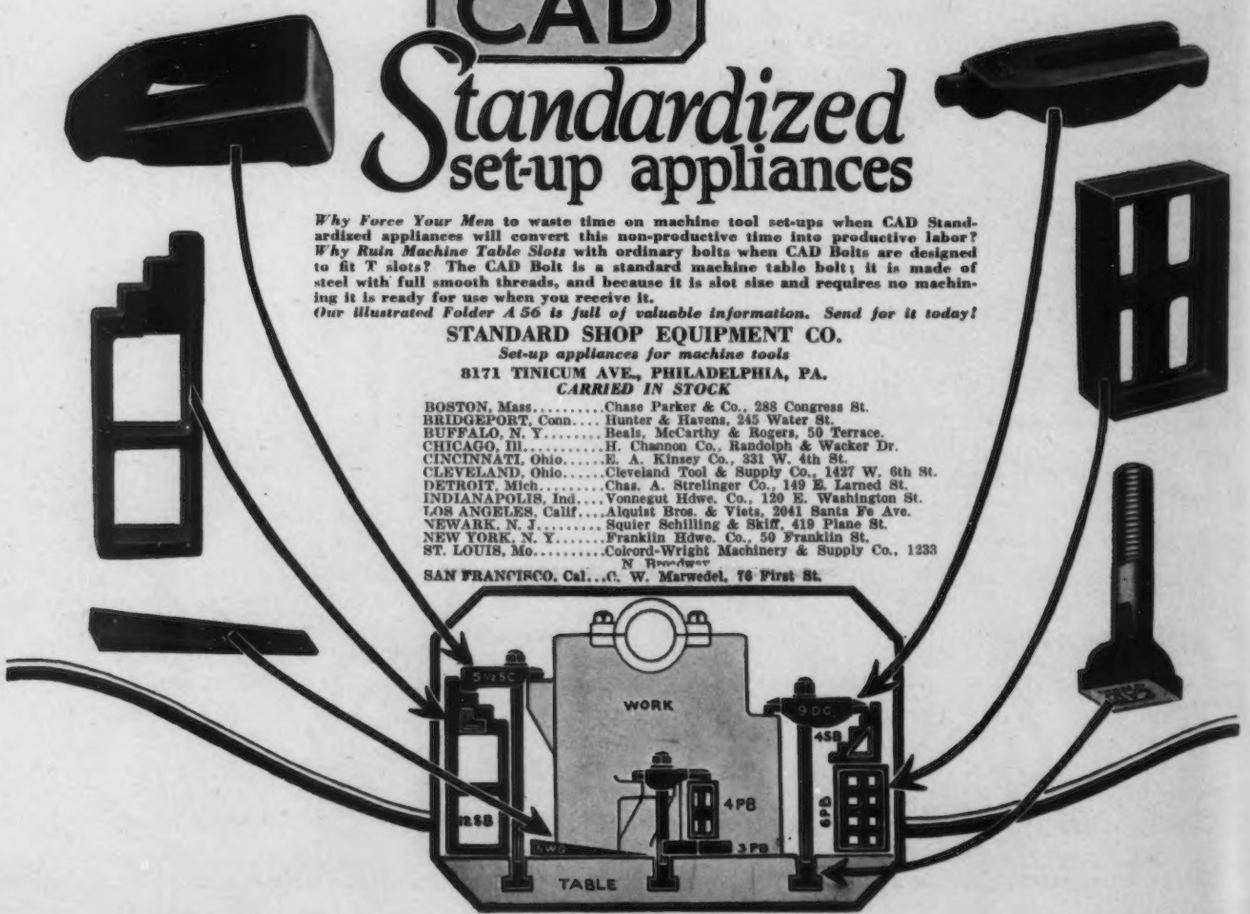

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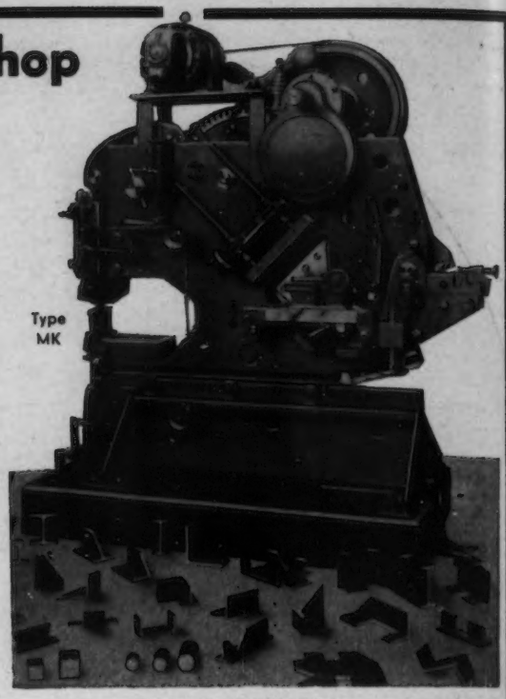

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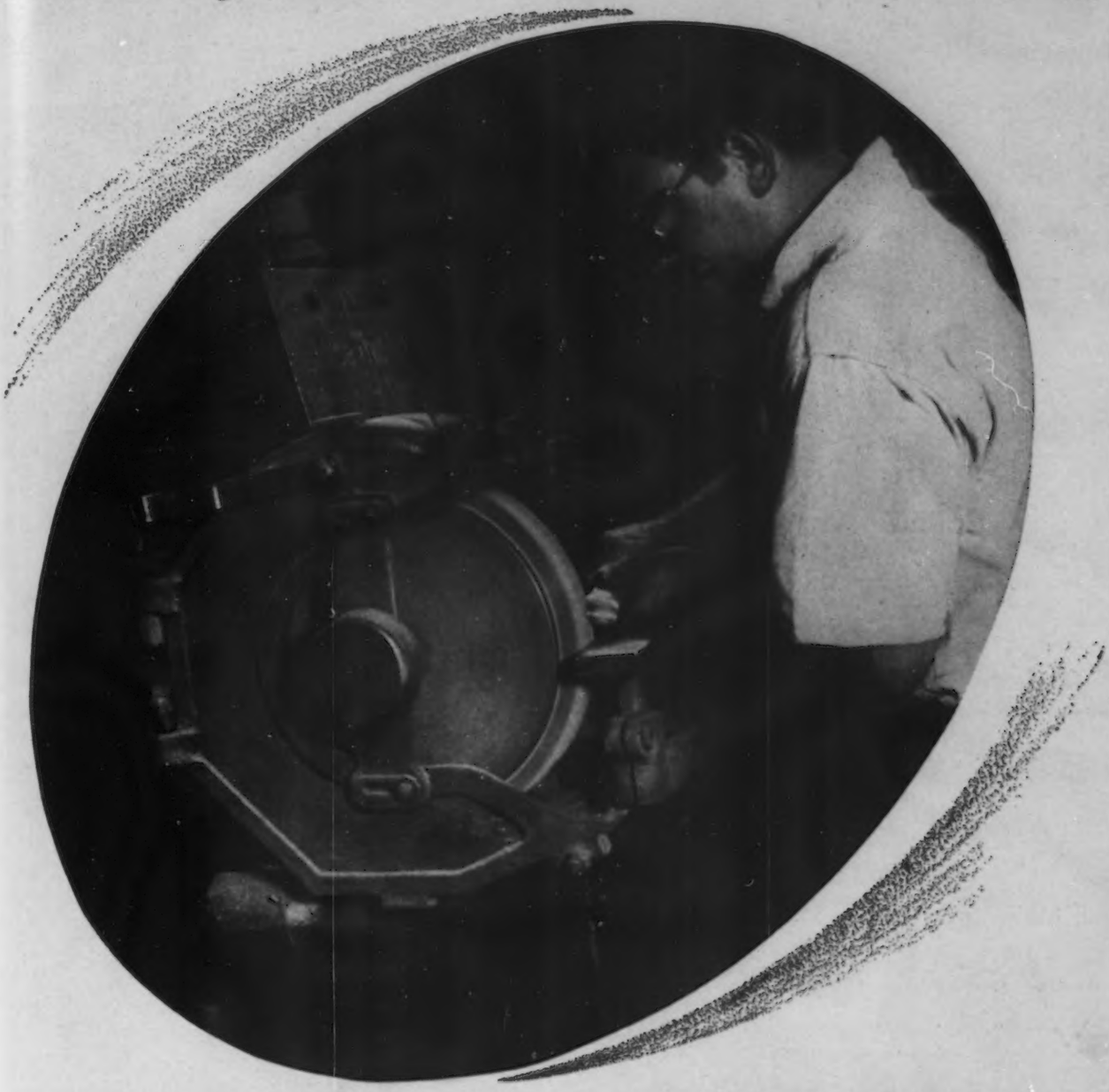

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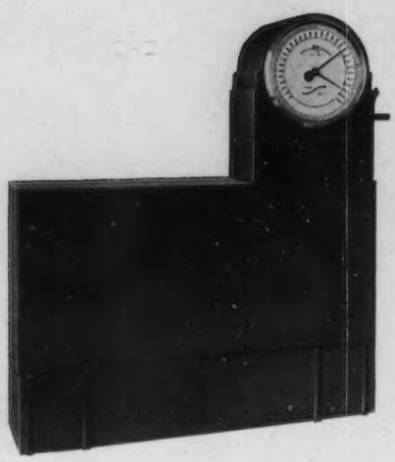

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But, totally apart from the fourth dimension and FitzGerald's contraction, industry has long had a private system of relativity. In measuring metal thickness, one of several gage systems may be used, none of which was originally refined for modern standards; or the engineer may write in thousandths of an inch, or even tie a complex weight gage to a thickness gage, the whole business adding up to a headache. All these gage systems are reviewed by Mr. Edgerton in the following article, their respective strengths and weaknesses are pointed out, and the author even advances a modified gage system of his own to inject some simplification into this mutable situation.

C. MEIMER

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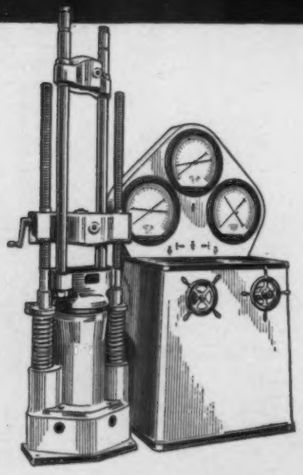

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A NEW GAGE SYSTEM

By M. B. EDGERTON*

o o o

IT is well known that gage numbers have been used for years as an expression of the thickness of metals, that is, when fractions of an inch are not more convenient. Also well known is that different fields in this country are covered by different gage number systems.

Thus, the field of the United States Standard Gage is that of steel sheets. The Birmingham Wire Gage is, or rather was, confined to steel strip, tube walls and a miscellaneous assortment of other product. The Steel Wire Gage, perhaps more often known as the Washburn & Moen Gage, has been universally used for steel wire; while the American Wire Gage, very frequently spoken of as the Brown & Sharpe Gage, reigns supreme in the non-ferrous industry.

Furthermore, there are even other gage systems in use, but the part they play is relatively small, and they are afforded little consideration in this discussion.

The gage systems used in England, or internationally, are almost unknown in this country except, perhaps, in such instances where material is fabricated for export.

Whereas the micrometer, measuring in thousandths of an inch, has long been known, it has not heretofore been called upon, nor has it been so highly developed in its many forms and universally used as during the past few years. These days a large percentage of mechanical construction is extremely refined, so engineers have arrived at a point where they talk and write in terms of thousandths of an inch as second nature. However, gage systems were not planned for and are not adapted to this new situation.

Designing engineers and fabricators of material are now expressing their opinions in thousandths of an inch where a few years back they were expressed in terms of gage numbers. This would not be so universally the case were it not due to the comparative inflexibility of the gage system and to an increasing demand for thicknesses not provided for by existing gage numbers. Both the sheet and strip steel and the steel wire industries have met the situation by making decimals of an inch prominent in their extra tables and using them in effect to set up lines of demarkation, marking the increase in extras necessary to take care of the increased cost of making thinner materials.

Much of the foregoing refers to the more important range of

*Engineer for International Harvester Co. for many years, both in this country and in Europe.

thicknesses below about ⅛ in. There is little demand for refinement for thicker material; in other words, the ordinary differentials now provided in fractions from ⅛ in. up seem to be ample, as even sixty-fourths are avoided.

There is no law involved in the gage systems except that in the case of United States Standard Gage on sheets, where it happens to be legal only in the sphere of determining duties and taxes levied by the Government. This law was passed in 1893, and as originally worked out it was really a law covering a system of weight gages rather than thickness gages. However, at that time, it was recognized that thicknesses must have a standing from an engineering standpoint; therefore, the originators indicated in a column in the text the thickness of iron sheets for each weight gage, using the specific gravity of iron as they then understand it to be. This tying of the iron thickness with the weight gage has been, so to speak, a curse to the industry ever since, because who would dare to arbitrarily and without force of authority set up what this thickness would work out for material of a different specific gravity, such as steel sheets; and even steel's density varies with the amount of alloying. Handbooks, which must perforce show the thickness of steel sheet gages, therefore varied because of varying conceptions of unit weights.

Standard Weight Set

Fortunately, within a few months past, the technical committees of the Association of Steel Manufacturers have set up a figure as the authoritative weight for each United States Standard Gage for steel thicknesses, and they have based this on 41.82 lb. per sq. ft. per in. of thickness. Since these standard gage thicknesses are now printed uniformly in the extra tables and literature of all steel companies, it has now practically all the necessary force to make it an unwritten law.

Flat steel material in these days is rolled to thickness as far as mechanical operation of rolling is concerned, and not to weight. This has not been true in the past as regards sheets, because until the development of the strip mill type of sheet mill, sheets were actually rolled to weight, and it was this practice prevailing in the old days which was probably the cause of the law of 1893 being set up as it was.

Attempts in the old days to reach very close uniformity of thickness from one sheet to another was not the first consideration, since the roller's job was to produce the correct number of square feet for all the sheets obtained from a certain weight of billet, and if he was able to do this and at the same time preserve uniformity of thickness from one sheet to another he was considered a prize operator indeed. This condition, as is well known now, has been entirely changed by the new type of mills producing possibly 90 per cent or more of the thinner gage sheets currently used.

It is interesting to note that a square foot of iron sheet metal of 18 gage should weigh exactly 2 lb. and have a thickness of 0.050 in., which is correct only for iron. In the new set-up just referred to, the 2 lb. requirement for 18 gage is retained, but the recognized and authoritative decimal for the thickness is now 0.0478 in., or, in other words, 0.0022 in. thinner than specified in the original law. It may also be mentioned that many of the commonly used handbooks which are used by engineers are still printing old and unauthorized thicknesses for steel sheets, one of the most prominent being 0.0490 in., which is 0.0012 in. different from the correct figure, or rather now recognized figure. But this final clarification of the steel figures for the United States Standard Gage is only one step in the line of advance which must necessarily take place.

Hot-rolled strip at one time was almost universally figured by the Birmingham Gage, at least for the thinner materials where fractions were not sufficiently practicable. The steel companies' order departments tolerate a confusion, including the use of the Birmingham Gage, because they wish to do nothing to alienate their customers.

However, the extra table for hot-rolled strip differentiates from price to price in the matter of thickness by decimals. Gage numbers are printed only for the convenience of the user, and the user is progressing and is learning to fall into step and order by decimal; so it may be predicted that relatively few orders will be received from the users in terms of Birmingham Gage numbers from now on, i. e., where fractions are not practicable, decimals will be used.

At one time the Birmingham Gage had a hold on cold-rolled strip, but this condition has passed, and now cold-rolled strip is figured in decimals, there being no price prejudice against any decimal chosen.

The steel company extra table setup for cold-rolled strip shows decimals prominently; in the case of regular cold-rolled strip decimals are used exclusively; for cold-rolled strip steel sizes which are considered as having a relationship to sheets, that is, to be interchangeably used with sheets, United States gage numbers are shown in addition to decimals. Probably a few orders will come through in United States Standard Gage, but generally speaking both the Birmingham and, in a large measure, the United States Standard Gage have no part in the ordering of cold-rolled strip.

Cold-rolled sheets, in spite of the fact that they are still attached to United States Standard Gage numbers, are increasingly ordered solely by the decimal; and, at present, the extra tables foster such a system of decimal order, any decimal being on the same footing as any other, as far as price is concerned. It is practice to indicate the equivalent decimal thickness when the party ordering chooses to specify a gage number, although for certainty they may also attach the gage number. Hot-rolled sheets, which, due to improvements in sheet rolling methods, is a dying commodity in the thinner gages, simply follow the practice just described for cold-rolled sheets.

So it is seen that as far as flat-rolled steel is concerned, sellers have maneuvered themselves by the process of evolution into a situation where they virtually have, or it would appear shortly will have, no gages in regular use, either by numbers or by decimals; there is some exception to this in the matter of sheets insofar as it may be convenient to speak of sheets in discussing market conditions in terms of gage numbers. As is well known, the steel companies, through their association, have defined the products just discussed as being confined to thicknesses less than 0.25

in., although they have also added certain width distinctions. Thus, those who think in terms of three-place decimals, when considering the thickness of material, have some 240 or more three-place decimals before them when picking the thickness required for their use; or if they think in terms of the greater refinement of four-place decimals, they have ten times this number. At this point, the reader is asked to use his imagination as to what this would mean in the end to designing and specifying departments when they are so uncontrolled by the lack of a set of standard decimal thicknesses.

Setting Up Own Figures

The sequel to this situation is for the user to set up his own standard decimals, which would

Proposed Standard Decimals for Steel Wire, Sheets, and Hot and Cold-Rolled Steel Strip

United States Standard Gage Decimals and Their Increments		Present U. S. S. Gage Used For Sheet Steel, Steel Thicknesses and Numbers		Divergence From U. S. S. Gage	Steel Wire and Washburn & Moen Gage		PROPOSED STANDARD DECIMALS			
							For Steel Wire	For Flat Steel		
								Sheets	Cold Strip	Hot Strip
500	063		1/2		4900	7/0*	**500**			
437	062		7/16		4305	5/0*	**437**			
375	031		3/8		3625	3/0	**375**		375	
344	032		11/32		3310	2/0	**344**		344	
312	015		5/16		3065	0	**312**		312	
297	016		19/64				297		297	
281	015		9/32		2830	1	**281**		281	
266	016		17/64		2625	2	**266**		266	
250	001		1/4		2437	3	**250**		250	
249	010	Thickest	Sheet					249	249	249
239	015	2391	3	0001			239	239	239	239
224	005	2242	4	0002	2253	4	**224**	224	224	224
219	010		7/32				219	**219**	**219**	**219**
209	009	2092	5	0002	2070	5	**209**	209	209	209
200	006						200	200	200	200
194	007	1943	6	0003	1920	6	**194**	194	194	194
187	008		3/16				187	**187**	**187**	**187**
179	007	1793	7	0003	1770	7	**179**	179	179	179
172	008		11/64				172	172	172	172
164	008	1644	8	0004	1620	8	**164**	**164**	**164**	**164**
156	007		5/32				156	**156**	**156**	**156**
149	009	1495	9	0005	1483	9	**149**	149	149	149
140	006		9/64				140	**140**	**140**	**140**
134	006	1345	10	0005	1350	10	**134**	**134**	**134**	**134**
128	003						128	128	128	128
125	005		1/8				**125**	**125**	**125**	**125**
120	005	1196	11	0004	1205	11	**120**	120	120	120
115	005						115	**115**	**115**	**115**
110	005		7/64				110	110	110	110
105	005	1046	12	0004	1055	12	**105**	**105**	**105**	105
100	002						**100**	**100**	**100**	**100**
098	003						098	098	098	098
095	005		3/32	Aporox.			**095**	**095**	**095**	**095**
090	006	0897	13	0003	0915	13	**090**	090	090	090
084	006						**084**	**084**	**084**	**084**
078	003		5/64		0800	14	**078**	078	078	078
075	004	0747	14	0003			**075**	**075**	**075**	**075**
071	004				0720	15	071	071	071	071
067	004	0673	15	0003			**067**	**067**	**067**	**067**
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057	003						057	057	057	057
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042	001	0418	19	0002			**042**	**042**	**042**	**042**
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032	002		1/32		03175	21	032	032	032	032
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021	003	0209	25	0001	0204	25	**021**	021	021	
018	002	0179	26	0001	0181	26	**018**	**018**	**018**	
016	001	0164	27	0004	0162	28*	**016**	016	016	
015	002	0149	28	0001	0150	29	**015**	**015**	015	
013	001	0135	29	0005	0130	31*	**013**	013	013	
012	001	0120	30	0000	0118	33*	**012**	**012**	**012**	
011	001	0105	31	0005	0104	34	**011**		011	
010	001	0097	32	0003	0095	35	**010**		**010**	
009	001	0090	33	0000	0090	36	**009**		009	
008	001	0082	34	0002	0080	38*	**008**		**008**	
007	001	00672	36*	00028	0070	40*	**007**		007	
006	0005	00598	38*	00002	0060	*43*	**006**		**006**	
0055	0005	00560	39	0001	0055	45*	**0055**		0055	
005	0005	00504	41*	00004	0050	47*	**005**		**005**	
0045	0005	00448	44**	00002	0044	*50*	**0045**		0045	
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*An omission of gage.
**Omission of two gages.

presumably be those ample for his own purpose and yet restricted in number, so as to keep down his inventory or to produce economies too numerous to mention.

Users are, as a matter of fact, doing just this. That is, they are setting up their own standard decimals without having at hand any standard to refer to, except perhaps the newly defined steel thicknesses of the United States Standard Gage numbers; and it can be shown that these are not refined enough as to increment to meet any manufacturing requirements. Therefore, orders are flowing in with decimal thicknesses specified, rather than gage numbers.

Resistance to Change

The apparent policy of sales departments of the steel industry (which are on a highly competitive basis) is first of all to cater to the customer. None of them wish to return an order which has been made out not in accordance with their liking or practice. The result of this is that when the customer is not curbed or guided, a never ceasing flow of correspondence results, some of it being of a serious nature. In any event, the result is confusion and an economic loss for all parties concerned.

In the case of steel wire, which is now in the province of the Steel Wire, or Washburn & Moen Gage, the use of gage numbers is far more prevalent. That is to say that, while steel sheets and strip seem to be slipping into a decimal system by a process of evolution, with a dropping of gage numbers, this is not the case with steel wire. For wire, gage numbers predominate and orders expressed in decimals are in the minority, although there is no price prejudice against a decimal not the equivalent of a wire gage number. It would seem, therefore, that the resistance to change from numbers to decimals would be greater and the accomplishment of the purpose much slower, or that considerable propaganda and strong sponsorship would be necessary in order to accomplish a change in the wire gage within a reasonable time, in spite of the fact that standard decimals for steel wire would probably be advantageous for both the wire manufacturers and users.

It so happens that to satisfy customer demands, the steel wire industry has drifted into a practice of acknowledging and defining quarter gages. This is because of the lack of refinement in the steel wire gage. At least this is done between 0.207 and 0.032 in., and the result of this action has been the creation of what amounts to a large number of new gage numbers.

With regard to the American Wire, or Brown & Sharpe Gage, while the practice of using and recognizing quarter gages does not prevail, it develops that even to a greater extent than the steel wire gage, the product is inexorably locked up from a copper wire standpoint with tables, data and existing fittings of the electrical industry; and since all non-ferrous products are tied to this gage when they are of the nature of wire or sheets or strips, it hardly seems possible that evolution within any reasonable length of time would eventually bring about a change from the use of numbers to decimals, or at least not to decimals which did not correspond to Brown & Sharp numbers. The resistance to change in this case being even greater than the case of steel wire, it would seem logical that they should be left out of any plan to eliminate numbers and tie up the product to a set of nationally sponsored standard decimals.

Summation

The writer has endeavored up to this point to develop reasonable conclusions which may be summarized about as follows:

First: That since the steel sheet and strip industry has gravitated to decimals for thicknesses, a set of standard decimals should be set up to meet this situation.

Second: That such a set of decimals nationally sponsored should, if possible, be of such a character that there would be a good chance of their acceptance for both sheet and strip steel and the steel wire industries, even if a wait of several years is necessary before the steel wire gage numbers as stock sizes could be eliminated and left off of printed matter.

Third: That any effort to drag along the Brown & Sharpe Gage for non-ferrous material would so injure the prospects of the acceptance of the first two proposals that this gage should be for the present left alone.

The newly determined thicknesses for United States Standard Gage numbers for steel sheets are now deeply ingrained in the industry, even though they were promulgated only a few months ago, and so any proposed gage system must take this into consideration. It is, therefore, presumed that satisfactory results can only be obtained by basing the standard decimal system on these newly defined gage thicknesses. Thus the transition from old practice to new would be accomplished with the least confusion.

It further seems obvious that such a system need only contain three place decimals, except in the case of very thin material. It seems to be a fact that where thicknesses are of the order of ⅛ in. or greater, the customer or user thinks, as a rule, in terms of fractions of an inch. Therefore, any gage system of decimals should include the commonly used fractions, or rather the decimal equivalents of these fractions.

New Gage System

Between the present 12 United States Standard Gage and 20 gage, the consumer and engineering demands point to a much greater refinement than is available by the range of thicknesses of the gage, and so this greater refinement should be made available.

In order to cater to the thicker wire gages ordered and to thicker cold-rolled strip which latter, although not authorized by the steel industry, is nevertheless manufactured to thicknesses greater than ¼ in., the upper limit may logically be set at 0.500 in.

Following such a line of reasoning, the thicknesses of the Birmingham and the Brown & Sharpe gages would be given no consideration. The Birmingham gage has been used for tube wall thicknesses, but now there is a movement within the industry which promises to change from Birmingham Wire Gage numbers to decimals. Such minor gages as those for piano wire would not by this set-up even be considered. That is to say, the piano wire industry would adjust itself to the standard decimals of a system based on a more important industry, namely, that of the manufacturer of sheets and strips.

It would seem that the above

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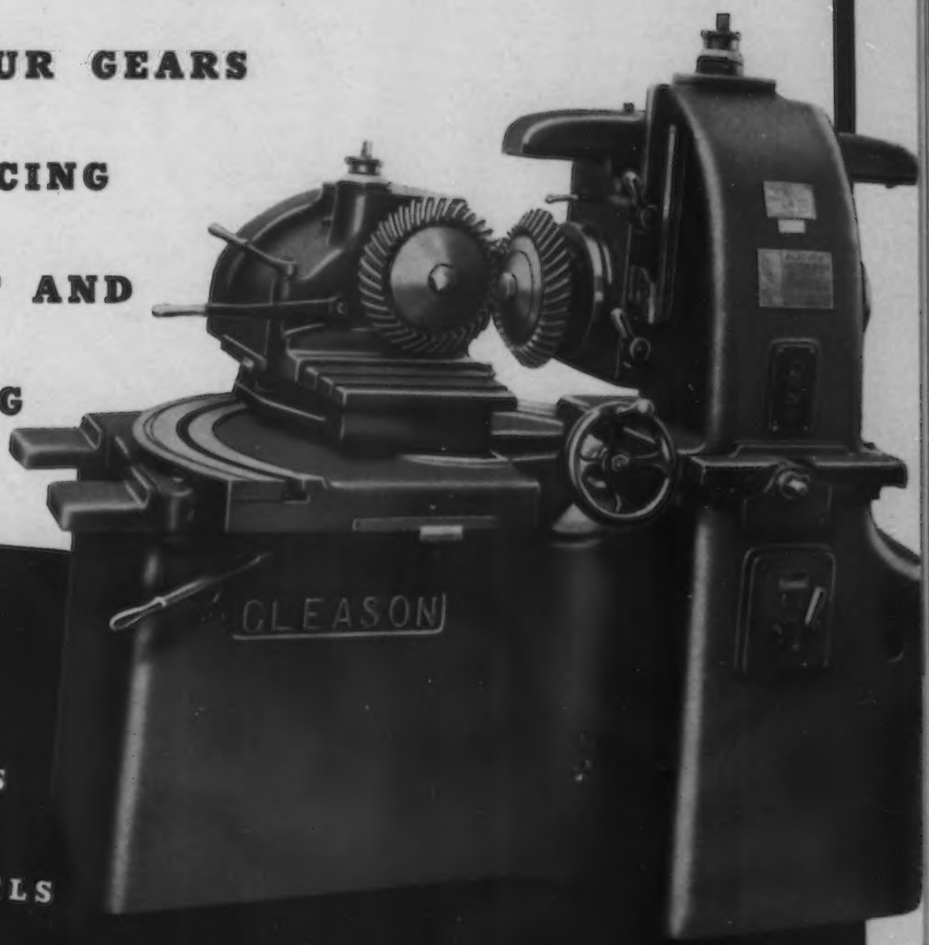

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conditions could be met by the decimals which are shown in the accompanying table, and attention is called to the fact that no gage numbers would be attached to these decimals, except that the user would, if he desired, attach the old United States Standard Gage numbers to the three-place version of them which he will find in the table.

In this table 0.200, 0.128, 0.044, 0.041, 0.035 and 0.032 are decimals which have been inserted in an effort to make the whole acceptable to the users of steel wire. Several other decimals are included in order to give a reasonable uniformity of increment and sufficient refinement. The decimal 0.249 is used because it would be the thickest material available from the sheet manufacturer under a sheet classification.

The table shows 81 decimals but, of course, it is not probable that any one consumer would operate his business by using all of them. In fact, his advantage would lie with his ability to reduce the number needed to a very minimum. Thus, such a table should be considered as a master guide from which he would draw off the standard thicknesses within which he wishes to confine his work.

The steel manufacturers would set up in their extra tables for their various products certain standard decimals which would represent the range that they were in position to supply the particular product; also, the consumer would be guided by these standard decimals found in the steel manufacturers' tables. However, even under such conditions, the number of decimals is too great for greatest economy and simplicity. Therefore, the standard decimals opposite each product would be divided into preferred and those which are not to be preferred. Such a proposed setup of decimals will be found in columns at the extreme right on the table; and those which are suggested as preferred will be noticed as defined by bold type.

The presumption is that the preferred decimals would be those which jobbing houses would carry, thus reducing the complexity of their stock but governed also by demonstrated customer requirements.

The table as shown includes the United States Standard Gage and certain fractions of an inch, as well as the Steel Wire Gage, merely in order to enable the reader to make comparisons.

Reference has previously been made to the fact that extra tables are so set up to show the price changes from one certain specified decimal to another. If such a setup of standard decimals were adopted as in the accompanying table, it would be found that if the consumer were to stick religiously to them he would, in a few cases, penalize himself from a cost standpoint. Therefore, those decimals in the extra tables should be modified where this is the case. This situation may be illustrated by the case of hot strip of a thickness of

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0.067 and 4 in. wide. A proposed standard decimal commands an extra of 50c per 100 lb. on account of thickness, whereas 0.068, which is not a proposed decimal, requires an extra of only 40c. Therefore, the customer would avoid a standard decimal in order to save 10c, in which case he would only penalize himself by the additional weight of 0.001 in. It would be a relatively easy matter for the steel industry to rectify this trouble so that it would be necessary for the customer to raise his thickness at least 0.002 in. before he could get into the lower price class.

Considerable change would be necessary for the galvanized sheet industry, and it seems likely that neither galvanizers nor consumers would care to incur the inconvenience and expense attendant upon adjusting themselves to decimal thicknesses, especially the ones proposed, which are different from the standard gage they are now using. Their gage thicknesses are not the same as United States Standard Gage thicknesses, and their sheets originally are rolled to thicknesses especially for their particular gage numbers.

This remark, however, does not apply to long ternes and other coated products, as the coatings in these cases are so thin that they need not be taken into consideration. Furthermore, stainless or alloy sheets offer no difficulties.

While tin mill black plate could follow into line, that part of the coated tin plate industry which has always maintained a definite relationship between the weight per box and the gage number would probably not be willing to fall into step. It would, therefore, be proposed that they continue their status the same as in the case of galvanized sheet.

Any tables set up in literature should be accompanied by weights per square foot, and, fortunately, the standard weight set up for steel sheets, namely 41.82 lb. per sq. ft. per in. of thickness will mean that all tables would be uniform in showing the same weights for a given decimal.

In the end all material is sold by weight, and, besides, uniformity and correct weights are needed by engineers.

If all tables disseminated were to include for reference purposes the old gage systems with their thicknesses, there should always be included at the same time a warning that they are not authorized for use and should be avoided; standard decimals being intended to displace them.

At this point it is especially pointed out that the writer holds no brief for the decimals set up in the table. It merely seemed necessary that the motions of defining the decimals be gone through in order to illustrate a situation which calls for relief from the confusion which is daily becoming worse and worse.

It is suggested by the author that some form of concerted action be taken to set up a suitable system to meet this condition.

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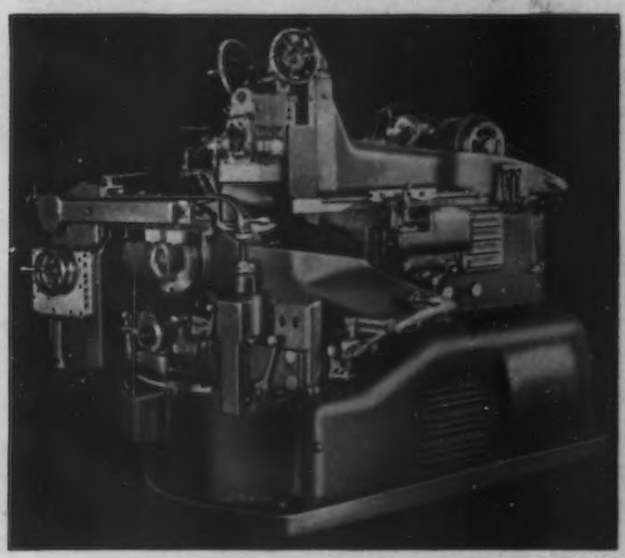

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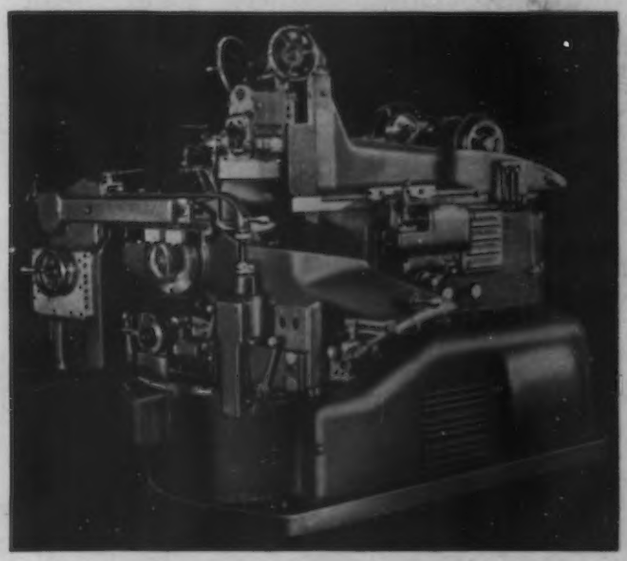

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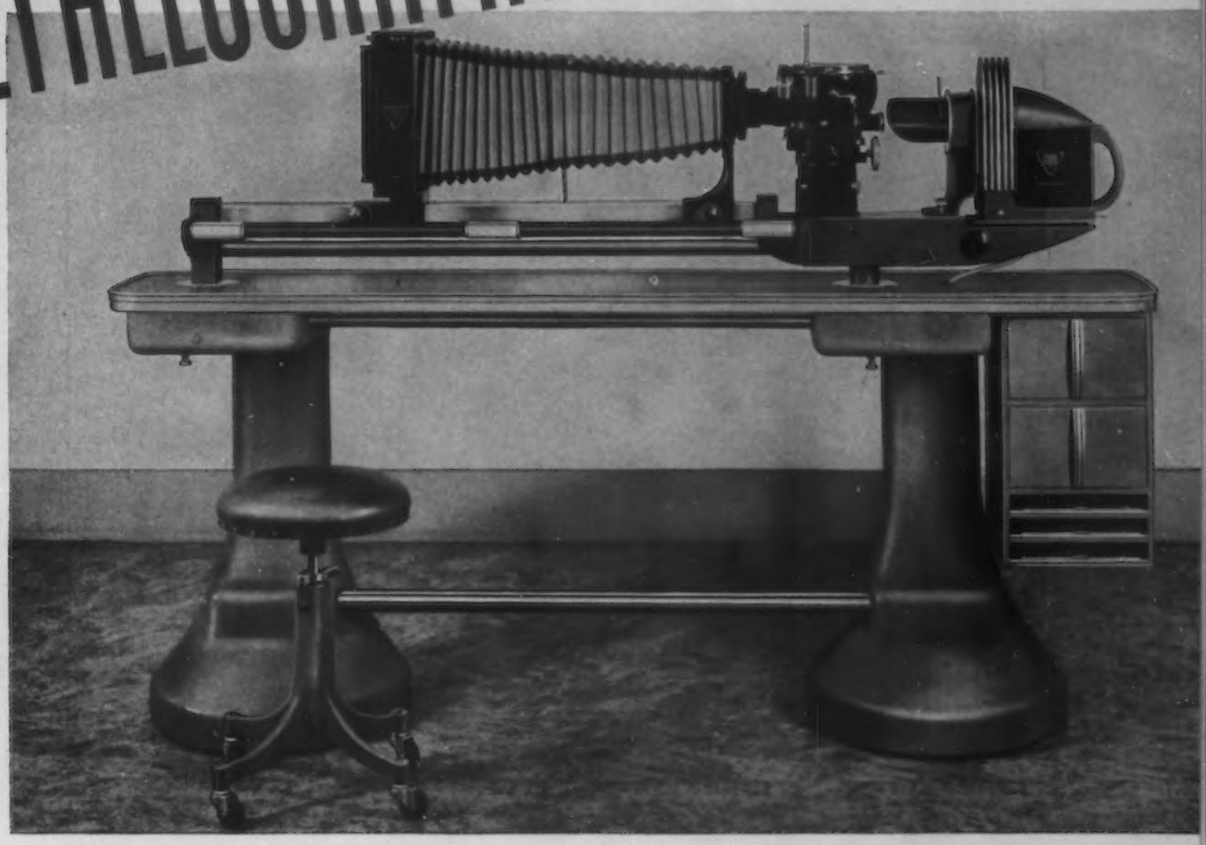

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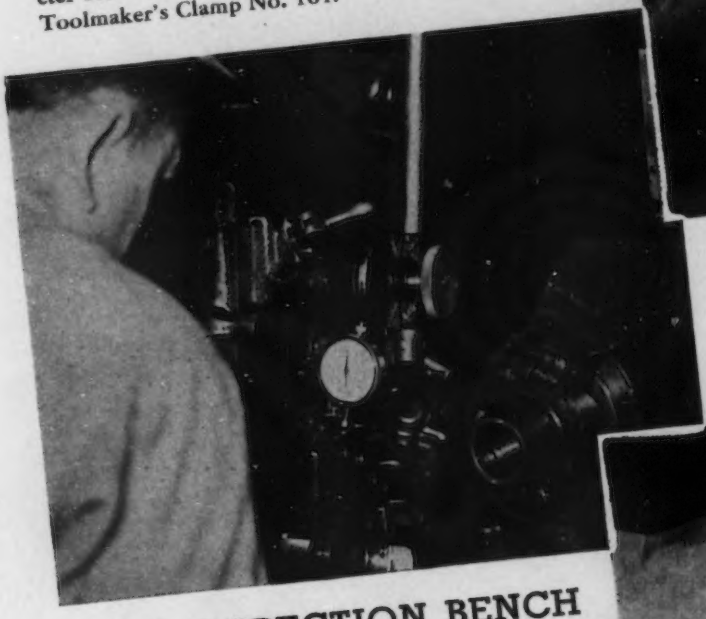

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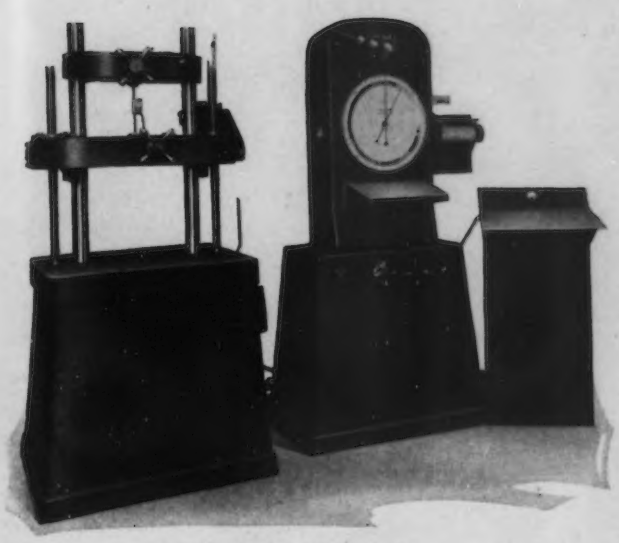

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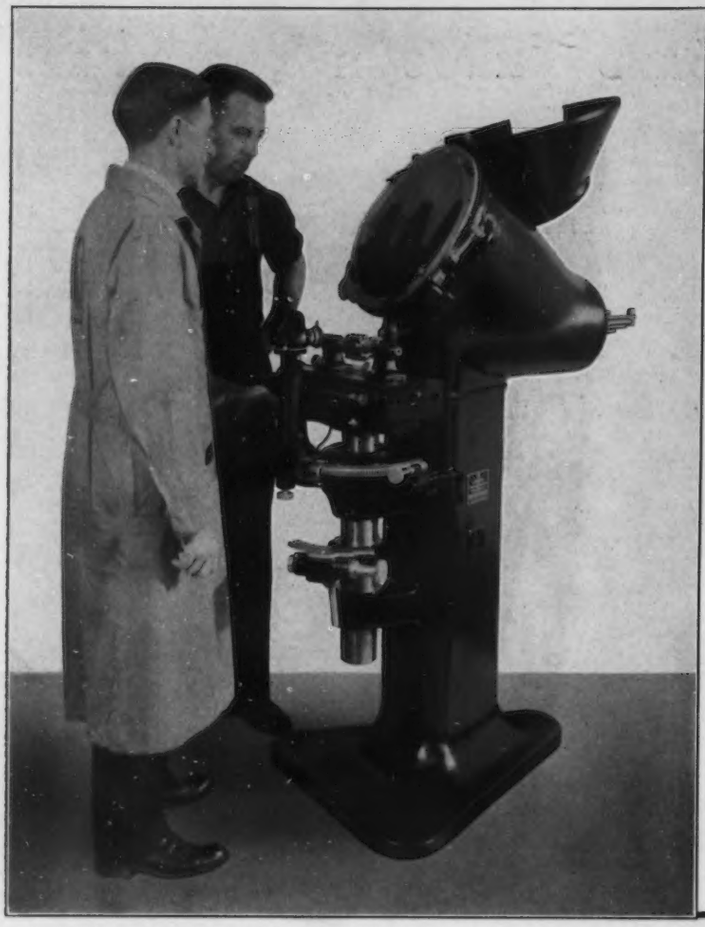

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THE IRON AGE

AT RIGHT

MORE than 350,000 tons of steel finds temporary storage each year alongside the Chevrolet Forge spring and bumper plant. Three cranes handle the stock which Crevrolet says is 3½ times the tonnage required for the 4200-ft. center span of the new Golden Gate bridge. This division has been at peak activity for weeks, manufacturing a bank of parts which is now feeding machines and assembly lines at Chevrolet's plants.

AT LEFT

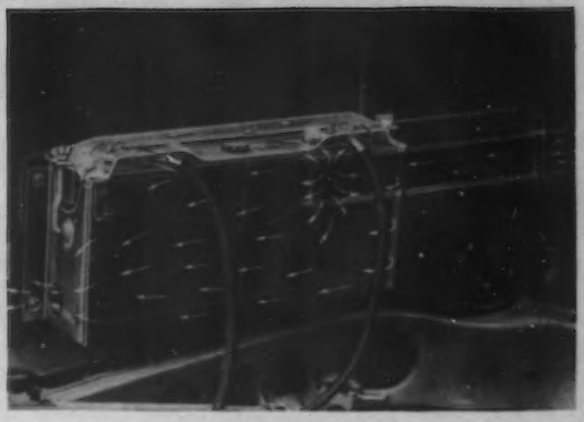
THIS new type steering wheel, designed for use with Oldsmobile's optional automatic transmission, gives clear vision of the centralized instrument unit. The transmission is operated by the short lever shown extending from the steering column at the right. The clutch is used only to start and stop the car.

FOLLOWING the general design introduced last year, the die cast, multiple bell shaped grille of the 1938 Oldsmobile Six is extended further back and grille slots have been added to the fender aprons.

o o o

AT RIGHT

OLDSMOBILE'S "end to end" battery is located in an air-cooled compartment beside the engine. A duct leads cool air to the battery from the front end of the engine compartment. Short lead wires reduce line loss, increase starter efficiency.



THIS WEEK ON THE ASSEMBLY LINE

. . . Production schedules stepped up by Ford and Chevrolet to build total of more than half million cars by Jan. 1.

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. . . Buick has $65,000,000 in orders for new cars and aims at $260,000,000 year ahead.

o o o

. . . Chevrolet assembles own frames after spreading stamping business; shipping costs lowered by new manufacturing plan.

o o o

. . . Ford's move in car pricing watched by industry; hesitancy of auto buyers becomes apparent.

DETROIT, Oct. 11.—At last some facts are available on production schedules for two of the major producers in the automobile industry. In each case there is an important upward revision. Ford has definitely scheduled 255,000 units to be built in the 40-day period after the resumption of production. Because the first bodies will probably not be delivered to the Rouge plant before the end of this week, pilot cars should roll off the line next Monday or Tuesday or as soon thereafter as practical and the initial schedule should be completed by the end of the year. Passenger cars to be produced will total 198,000, with two of the 85 hp. type for every 60 hp. car. There will be 22,000 commercial cars (the half-ton truck) and 35,000 trucks.

Chevrolet, finally in production last week on a small volume of cars, has scheduled itself to build 204,000 cars before Dec. 1—85,000 of them by the end of this month and 119,000 in November. At that rate, and considering plant capacity, there should be another 100,000 to 120,000 cars produced by Chevrolet during December. The lead which Chevrolet will get during October should therefore put Chevrolet out in front by the first of the year, with 305,000 compared to 255,000 for Ford.

These schedules are both heavier than corresponding schedules of a year ago for Ford and Chevrolet. Last year Ford's production of new models up to the first of the year was only 187,000 and Chevrolet's was 293,482.

To produce this number of cars as actually scheduled by these two companies means using the plants to capacity every working day and presupposes the absence of strikes. In Ford's case, for instance, it means an average of 6375 cars a day, the kind of pace that Ford was establishing late in the spring and early last summer. Chevrolet's schedule, as it is set up through the end of November, requires the production of 5400 cars a day, this in spite of the fact that Chevrolet's engine plant can produce only 5200 a day. Obviously there is a backlog of engines to count upon and overtime may be necessary, although automobile manufacturers are shying away even from the word. During the past week Briggs started making up the first two 1938 Ford bodies. They are still in the "white" or uncompleted stage but it is certain that appearance changes will not be very great.

Among the other producers, indications are that they, too, will press as hard as possible to build large numbers of cars in the near future. Generally the attitude is that there must be a backlog in case of labor trouble. DeSoto is now running about 400 cars a day, aiming at 500 to 525 at the peak. Buick is averaging more than 1100 cars daily and the company reports that pre-announcement orders are running 20 per cent ahead of the corresponding date last year. It has more than 65,000 unfilled orders on its books, representing in excess of $65,000,000 worth of business. Harlow H. Curtice, Buick president, declares that orders on hand and in the field are sufficient to keep the factories operating at capacity to Jan. 1. The model year objective of 260,000 cars will be met by speeding up assembly lines soon to turn out 1500 cars a day. On the basis of $1,000 per car, this represents $260,000,000 worth of automobile business.

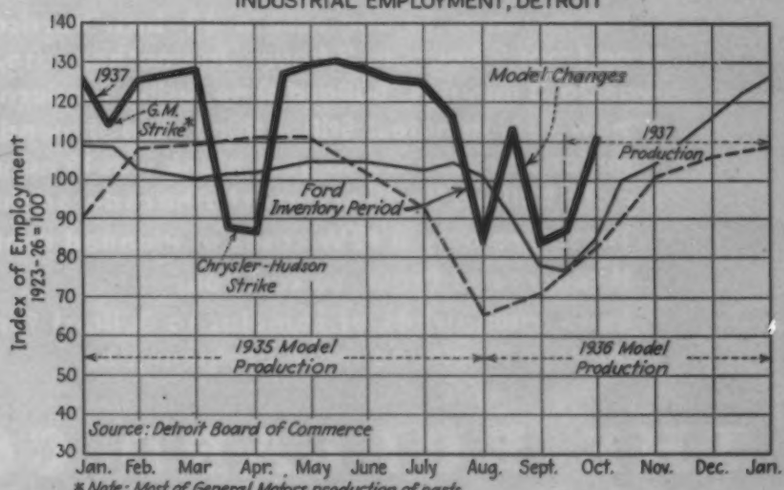
Ford's engine assembly line has parallel to it one of the most unusual lines in the automobile industry. It is the place where the Ford

Motor Co. rebuilds nearly 1000 engines a day to be used as replacements in service. Nowhere else in the world is such a large repair service offered. Actually the work amounts to reconditioning the engine so it is practically new. The schedule for the next few months calls for 125 of the Model A engines each day, 50 Model B and 790 V-8. To date 325,000 of the old Model A have been put through the factory reconditioning service, 35,000 of them since the first of the year. Of the Model B, 96,000 have gone down the line, 30,000 of these in the last ten months; 456,000 V-8 have been rebuilt for customers, 176,000 of these since Jan. 1. The process is to tear the engine down completely and go through the same checking for accuracy and assembly as on the new car engines, with new parts replacing those no longer satisfactory for service. The fact that 15 per cent of the engine assembly line output is in this classification accounts for a large number of the parts which dealers ship into the plant and is an important item in the Ford schedule of many vendors.

Frame assembly departments have been added at all Chevrolet assembly plants because of a new policy adopted by that company. Formerly complete frames were purchased from two companies and shipped already assembled. A manufacturing problem was the fundamental reason for this, because certainly from the viewpoint of shipping, it was not the most satisfactory or cheapest arrangement. A change in an apparently minor drafting room practice, at least in frame designing, made possible the savings in freight and greater ease of handling. A study of "limit stacks" and tolerances was made which showed that revision in drafting practice with regard to dimensioning reduced by 60 per cent the variation of over-all dimensions on frame side rails. Thus, while still remaining inside commercially practical limits on tolerances, it is possible to manufacture the frame stampings in a number of plants and be certain of easy assembly when all the parts get together. This possibility of having a number of vendors supplying each part is particularly important because it eliminates much of the danger from strike tie-ups. It also scatters the stamping business to the advantage of a large number of vendors, many of the smaller shops benefiting because they are capable of producing small parts such as cross members and brackets.

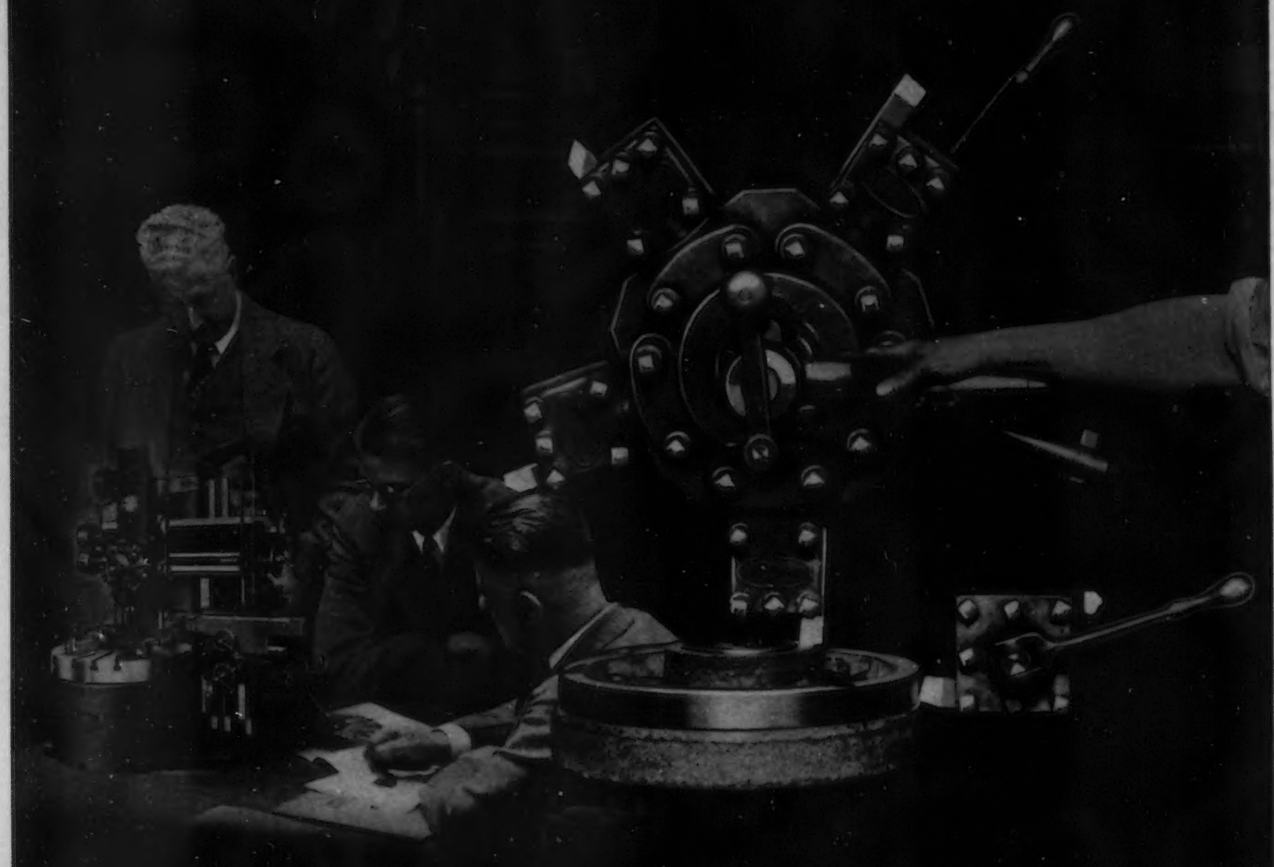
Automobile production forged upward last week to a level untouched in any week of October, 1936, according to Ward's Automotive Reports. The 100,000 car week may be seen before the end of the month. Last week's output was 71,958, compared with the revised total of 44,330 in the preceding week and 41,360 a year ago at this time. With production going this way, all of the manufacturers should have complete dealer stocks in the field at the time the National Automobile Show begins in New York Oct. 27. This is regarded as important from the sales standpoint because manufacturers who have been late have discovered that customers forget about them and go elsewhere. Registration figures for September are just coming in and indicate 220,000 new car sales last month. R. L. Polk & Co., on the basis of data from 10 states, predicts that the month's sales will be about 8 per cent higher than a

INDUSTRIAL EMPLOYMENT, DETROIT



*Note: Most of General Motors production of parts and cars is outside of Metropolitan Detroit

PLANNED PROFITS



TODAY, the Aim of Industry is toward Planned Profits instead of Haphazard Profits.

Bullard Engineering Service has in many instances assisted in planning ways and means toward Profits, and Bullard Vertical Turret Lathes have produced the Planned Profits.

For instance, in one case a 42-inch Vertical Turret Lathe cut time from 9 hours to 2 hours. In another case, the previous time was 26.0 minutes. Bullard time, using modern type cutting tools, is now 11-¾ minutes. Still a third case showed the best previous time for a bronze worm gear blank was 12 minutes. Planned tooling of a Bullard Vertical Turret Lathe reduced the time to 3 minutes.

These are only a FEW cases of Planned Profits.

If others can Profit, so can You.

Send your prints or samples to Bullard for Estimates. Let us plan your Profits on those problem jobs.

THE BULLARD COMPANY

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year ago and 26 per cent lower than August, this year. Truck and commercial car sales for September are estimated at 50,000.

Although no large volume of steel has been ordered even yet, substantial orders have been coming from General Motors and Chrysler for more than a week and Ford is now in the market for enough steel to build another 125,000 cars, it is reported. One persistent rumor says that Ford is debating the price question with steel suppliers. Customers have all been given the assurance that price increases are not in prospect. Ford always has a little club, of course, in the fact that Ford, too, is a manufacturer of steel.

Ford's new expansion program, referred to in detail elsewhere in this issue, will include the construction of a new blast furnace of 1000 tons a day capacity. Some details of the new program have previously been published, such as a new coke plant of 61 ovens, now under construction, and the rebuilding of the present open-hearth furnaces. Thus, while greater capacity is in the offing, there will be a temporary slump in output of steel while reconstruction is going on.

Briggs has put a little more pressure on in its demand for steel, one typical case being an order for 6000 sheets scheduled at 1000 each week until the order is completed. This was increased to 8250 sheets, to be delivered at the rate of 2000 a week. Packard, however, still finds itself in an unpleasant situation with the steel it ordered in June. Delivery was to start in August, but now shipment is delayed, although it should have been completed by now. Before these deliveries could start, however, Packard had steel piled to the craneways in its storage place and because of delays on getting into production, it has been necessary to reschedule much of its steel deliveries. Some deliveries have been delayed until as late as Dec. 10.

The automobile price situation is having upsetting effect, in the opinion of observers who have visited sales rooms where new cars are on display, as many already are in the Detroit area. There has been a noticeable lack of enthusiasm on the part of prospects and it is frankly admitted in some quarters that prospects seem to be none too plentiful. The effects of higher prices predominate, but an unpleasant aspect is introduced by the fact that showroom visitors make frequent reference to the depression in the stock market and to their fears that business in general has suffered a setback. Price increases that have been put through by Pontiac and Dodge have resulted in an unusual situation. Last year Dodge could boast that its models were approximately $10 less expensive than Pontiac's, but this year it is $10 above the Pontiac level. Chevrolet has not announced its new prices, but another increase of $25 is anticipated over and above the $35 boost put through earlier. Of course firms that took the step in August can now announce their prices as only nominal increases over the last 1937 quotations. Those who did not take the step earlier must add the increase all in one lump.

Ford's position is believed by some to be exceptionally good. He led the field in announcing price increases of about $7 to $35 late in the summer and thereby drew out all his competitors. Now he has a very good idea of what their 1938 prices are going to be. One good guess is that he may steal a march on the field by announcing that his present price will stand through 1938.

The CIO made a surprising stand in Detroit's municipal election and is planning now to set up a permanent political organization in Detroit which will broaden to cover all of Michigan. CIO candidates who were nominated include former Judge Patrick H. O'Brien, who ran second in the mayoralty poll, and five CIO Council candidates—Maurice Sugar, UAW lawyer and left-wing leader; Richard T. Frankensteen and R. J. Thomas, UAW vice-presidents, and Tracy M. Doll and Walter Reuther, also UAW officials. O'Brien was far enough behind Richard W. Reading, former city clerk, that he will have a difficult battle to win the election, but at present there is an attempt to arrange a deal between the CIO forces and the Detroit and Wayne County Federation of Labor, which would throw AFL support behind the CIO slate now that John W. Smith, AFL favorite, is out of the running because of his defeat in the primary. It is reported that a quarter million dollars in the coffers of Labor's Non-Partisan League is available to finance the campaigns of O'Brien and the five Council candidates.

At least $100,000 is being spent in the United States to organize technical workers into the Federation of Architects, Engineers, Chemists and Technicians, a recent CIO affiliate. This group began its international convention in the Book-Cadillac Hotel, Detroit, last Thursday and wound up Sunday night. According to officials in this group, which was organized as an independent union in 1933, affiliation with the CIO was completed last August. On the day terms were reached, John L. Lewis handed over a check for $2,500 to put into the field immediately a staff of organizers. Since then, $52,000 has been poured into their efforts by the CIO and the rest of the $100,000 is on hand.

Ford Motor Co.'s Improvement Program To Cost $40,000,000

THE Ford Motor Co., Detroit, on Monday announced that its present construction program, some features of which have previously been published, will cost approximately $40,000,000. New construction will be divided between its iron and steel plants and its automobile manufacturing divisions.

A new blast furnace with daily capacity of 1000 tons will be added to the iron plant, which now consists of two furnaces, each with 275,000 tons annually. As an auxiliary of the iron plant, the Ford company now has under construction a battery of 61 coke ovens. Additional ore storage and handling equipment also will be installed.

The open-hearth building will be enlarged to permit installation of new bessemer converters. Nine of the open-hearth furnaces will be rebuilt.

A new building to house an alloy steel foundry will cover about eight acres and will increase the foundry department to about 38 acres.

Changes will also be made in the steel finishing departments. The hot strip mill will be widened to roll a 60-in. sheet instead of a 48-in. sheet as at present. In the new cold finishing mill will be installed a 78-in. continuous pickling machine and 12 sets of bright anneal electric furnaces.

An inquiry was issued recently by the company for 15,000 tons of fabricated structural steel for a new press shop.

With these improvements, the company's ore reqirements will expand to 1,500,000 tons annually compared with 850,000 tons at present and it will be more self-contained as to requirements of iron and steel.

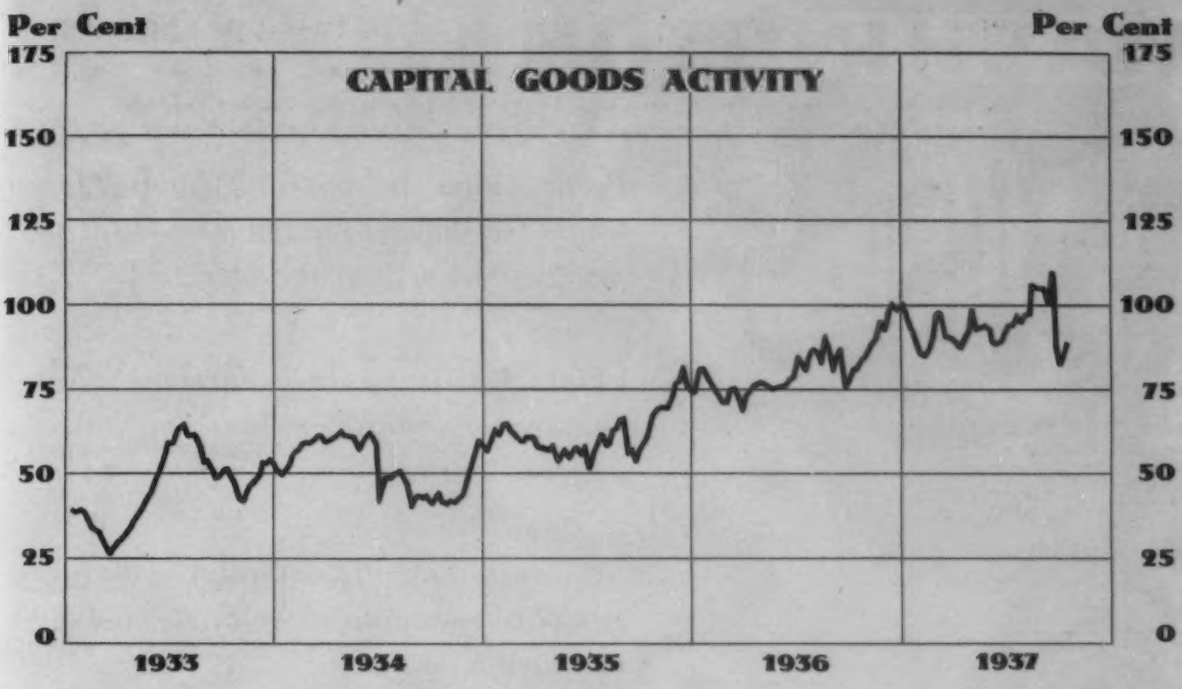
Current Metal Working Activity Statistically Shown

These Data Are Assembled by The Iron Age from Recognized Sources and Are Changed Regularly as More Recent Figures Are Made Available. Boldface Type Indicates Changes This Week

	August 1937	July 1937	August 1936	Eight Months 1936	Eight Months 1937
Raw Materials:					
Lake ore consumption (gross tons)[a]	5,373,264	5,236,487	3,968,845	27,407,391	39,983,710
Coke production (net tons)[b]	4,829,862	4,707,106	3,993,602	29,104,700	37,056,796
Pig Iron:					
Pig iron output—monthly (gross tons)[c]	2,711,721	3,498,858	2,711,721	18,834,215	26,811,269
Pig iron output—daily (gross tons)[c]	87,475	112,866	87,475	77,189	109,882
Castings:					
Malleable castings—production (net tons)[d]	49,022	45,479	42,253	360,758	446,356
Malleable castings—orders (net tons)[d]	49,376	41,353	45,179	351,265	425,587
Steel castings—production (net tons)[d]	92,089	86,978	81,574	501,810	775,628
Steel castings—orders (net tons)[d]	54,753	57,799	59,393	559,948	721,460
Steel Ingots:					
Steel ingot production—monthly (gross tons)[e]	4,861,789	4,556,596	4,184,287	29,374,754	38,183,018
Steel ingot production—weekly average (gross tons)[e]	1,097,469	1,030,904	944,534	842,649	1,099,741
Steel ingot production—per cent of capacity[e]	83.55	78.49	72.11	64.33	83.73
Finished Steel:					
Trackwork shipments (net tons)[e]	7,530	8,252	6,401	47,209	69,790
Fabricated shape orders (net tons)[g]	117,612	160,970	110,687	1,071,720	1,197,381
Fabricated shape shipments (net tons)[g]	158,228	144,560	142,709	990,077	1,082,844
Fabricated plate orders (net tons)[d]	30,212	*27,480	31,999	323,730	308,937
U. S. Steel Corp. shipments (tons)[h]	1,107,858	1,186,752	923,703	6,905,904	9,908,884
Ohio River steel shipments (net tons)[i]	133,650	163,705	113,560	689,676	955,045
Fabricated Products:					
Automobile production, U. S. and Canada[k]	405,064	*456,909	275,934	3,321,648	*3,779,393
Construction contracts, 37 Eastern States[l]	$285,104,100	$321,602,700	$275,281,400	$1,807,356,700	$2,100,358,000
Steel barrel shipments (number)[d]	771,427	715,014	599,125	5,251,254	6,812,768
Steel furniture shipments (dollars)[d]	$2,022,913	$2,071,417	$1,438,611	$12,160,745	$17,804,516
Steel boiler orders (sq. ft.)[d]	917,927	979,316	1,080,552	6,841,109	7,350,552
Locomotive orders (number)[m]	39	3	3	134	270
Freight car orders (number)[m]	1,490	†30	3,225	34,248	46,610
Machine tool index[n]	179.8	171.1	127.5	†135.5	†180.9
Foundry equipment index[o]	257.5	204.0	145.4	†148.8	†229.9
Foreign Trade:					
Total iron and steel imports (gross tons)[p]	61,489	47,012	60,688	427,773	407,015
Imports of pig iron (gross tons)[p]	7,952	8,310	12,524	122,527	76,127
Imports of all rolled steel (gross tons)[p]	26,983	26,116	28,216	171,622	224,744
Total iron and steel exports (gross tons)[p]	886,319	889,468	295,341	2,217,884	5,318,524
Exports of all rolled steel (gross tons)[p]	286,774	285,782	89,128	716,052	1,594,753
Exports of finished steel (gross tons)[p]	202,949	224,121	79,617	650,554	1,322,249
Exports of scrap (gross tons)[p]	473,933	420,097	194,600	1,432,843	3,028,795
British Production:					
British pig iron production (gross tons)[r]	712,600	729,300	635,800	5,046,000	5,432,900
British steel ingot production (gross tons)[r]	987,700	1,059,200	872,700	7,591,000	8,385,300
Non-Ferrous Metals:					
Lead production (net tons)[s]	46,965	45,496	33,542	297,133	346,595
Lead shipments (net tons)[s]	54,551	47,727	46,388	301,121	414,918
Zinc production (net tons)[t]	48,309	49,181	43,614	352,899	378,080
Zinc shipments (net tons)[t]	50,643	49,701	46,085	340,463	419,808
Deliveries of tin (gross tons)[v]	7,580	4,980	5,385	49,525	56,995
Copper production, refined (net tons)[w]	80,135	79,611	55,410	465,575	647,211

† Three months' average. * Revised.

Source of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [g] American Institute of Steel Construction; [h] United States Steel Corp.; [i] United States Engineer, Pittsburgh; [k] When preliminary from Automobile Manufacturers Association—Final figures from Bureau of Census. [l] F. W. Dodge Corp.; [m] *Railway Age;* [n] National Machine Tool Builders Association; [o] Foundry Equipment Manufacturers Association; [p] Department of Commerce; [r] British Iron and Steel Federation; [s] American Bureau of Metal Statistics; [t] American Zinc Institute, Inc.; [v] New York Commodities Exchange; [w] Copper Institute.



The Iron Age Weekly Index of Capital Goods Activity

(1925-27 = 100)

Last week	88.3	Same week 1933	51.3
Preceding week	84.7*	Same week 1932	33.5
Same week last month	110.0	Same week 1931	52.0
Same week 1936	81.0	Same week 1930	76.2
Same week 1935	59.0	Same week 1929	112.1
Same week 1934	42.5	* Revised	

ACTIVITY in the production and distribution of durable goods showed a gain of 3.6 points for the week ended Oct. 9, according to THE IRON AGE seasonally adjusted index. This advance, the second in as many weeks, brings the index up to 88.3 from the year's low point of 82.9 three weeks ago. Revisions in Ward's estimate of automobile production for the week of Oct. 2 necessitated adjusting the index figure for that week to 84.7. A continued increase in automobile production as assembly lines gather momentum on the new models resulted in a weighted gain of 29.6 points in this factor of the index. Steel production, which has been declining in the face of the usual upward seasonal trend, showed a loss of 10 points after adjustment. This establishes a new low for the year in this series. Further losses of 0.6 points in lumber carloadings, 2.1 points in Pittsburgh activity and 1.2 points in heavy construction awards were also recorded.

	Latest Week	Change from Preceding Week
Steel production (per cent of capacity)	66.0	—8.0
Automobile production (number of cars and trucks)	71,958	+27,628
Railroad loadings of forest products (number of cars)	38,595	—689
Pittsburgh industrial production and shipments (index number)	95.0	—2.6
Construction contracts awarded (total value)	$48,830,000	+$6,336,000

Components of The Index (1) Steel Ingot Production Rate, from THE IRON AGE; (2) Automobile Production, from Ward's Automotive Reports; (3) Revenue Freight Carloadings of Forest Products, from Association of American Railroads; (4) Industrial Productive Activity in Pittsburgh District, from Bureau of Business Research of University of Pittsburgh; (5) Heavy Construction Contract Awards, from *Engineering News-Record.*

WASHINGTON. . . . . .

. . . Participation in boycott against Japan would take largest foreign market for steel products from United States.

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. . . China, Russia increase purchase of war supplies as industry weighs possibility of Nippon sanctions.

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. . . Attorney General Cummings again urges anti-trust law commission be formed to hit identical bidding.

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By L. W. MOFFETT
Resident Washington Editor
The Iron Age

o o o

WASHINGTON, Oct. 12.—With the attention of the country partially diverted from important domestic problems to a serious foreign situation by the President's startling Chicago speech offering complete collaboration to "quarantine" disturbers of international peace, widespread speculation here and abroad has quickly developed as to the possibility of a boycott against Japan by the United States, Great Britain and France.

Further force was given the discussion, which seemed to lead nearer to concerted international action to isolate Japan from the leading markets of the world and thus further weaken her already weak financial condition by the formal accusation by the State Department, following immediately after the President's pronouncement, charging Japan with violating the Nine-Power pact and the Kellogg-Briand treaty.

Bluntly, the State Department branded Japan as the aggressor in the Sino-Japanese war.

The Administration is withholding further public moves for the present. Apparently it is awaiting developments both here and abroad before taking any definite steps toward applying "sanctions" against Japan.

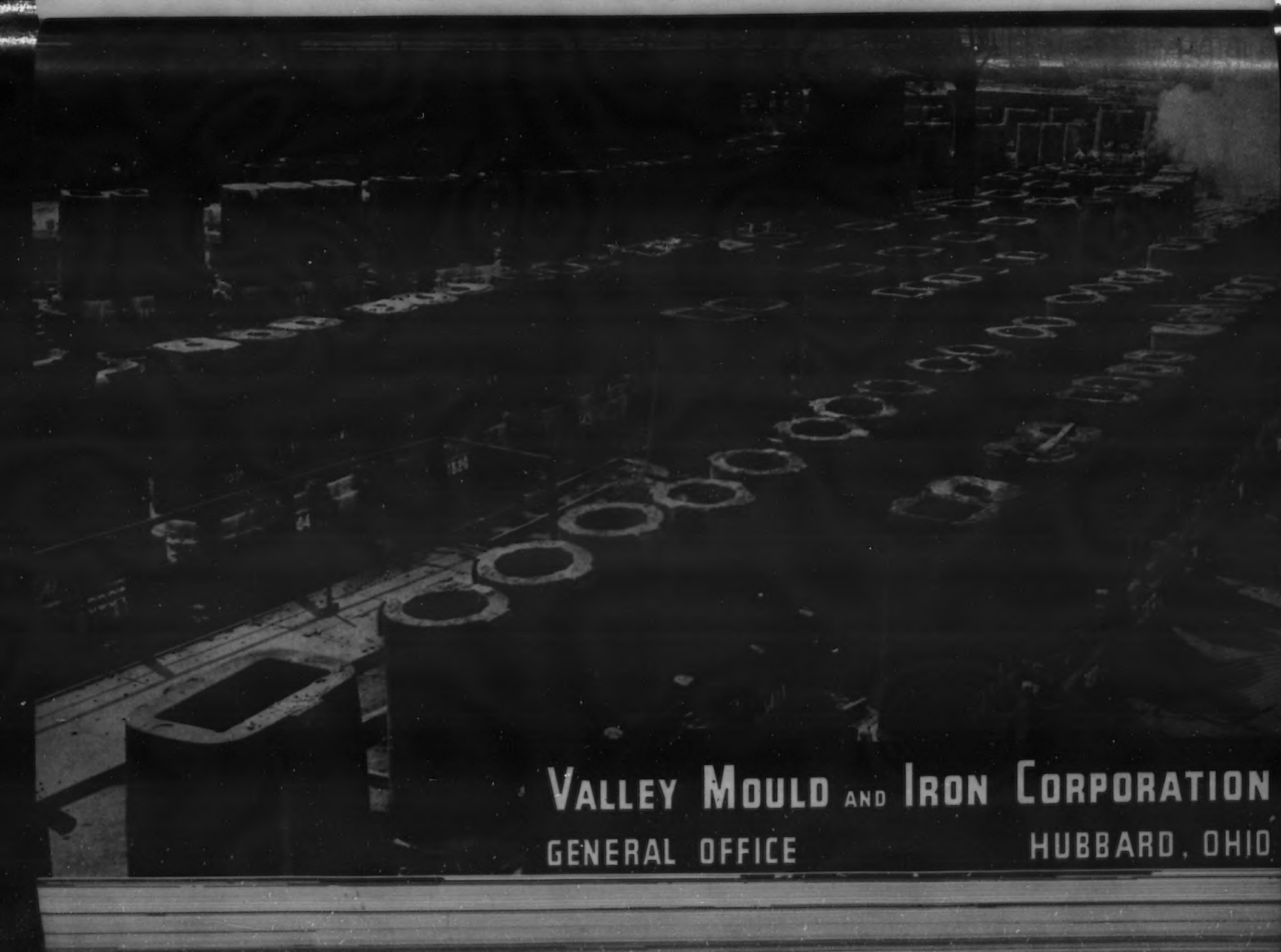
Though efforts are being made to emphasize the fact that "sanctions" if applied would not go beyond setting up trade barriers, it is evident from the country's reaction that it fears armed conflict. Distinctly, the overwhelming sentiment is strongly against the United States getting mixed up into a foreign imbroglio. Yet there is a conflicting view that Japan must be curbed and that America should share the obligation. Pro and con arguments are being made without end as to the possibility of armed intervention. Fear of this has not been allayed by the mere assurance of the President that he proposes that the United States shall remain at peace.

These matters aside, it may be pointed out as a secondary and relatively unimportant matter that a boycott against Japan would see the iron and steel industry of the country lose its most important foreign market, though the loss perhaps would be more than offset by increased shipments to countries actually participating in the boycott and those in sympathy with it.

As for scrap, Japan also nas been by far the largest foreign purchaser of American old material. However, it is definitely understood that Japan now is entirely out of the scrap market and has been for two or three months. Hence, under this circumstance, scrap dealers would not lose foreign trade through a trade ban imposed against Japan. It is not clear whether Japan still is buying pig iron and steel tonnages in this country to any great extent or as in the case of scrap simply is accepting shipments on old contracts.

In the first seven months of the present year exports of scrap to Japan totaled 1,529,411 gross tons. Pig iron exports to Japan were 280,444 tons. Exports of ingots and semi-finished steel, mostly ingots, were 80,291 tons. Japan is not buying much from this country in the way of actual finished munitions or military equipment. Licensed purchases in September, according to the monthly report of the State Department on licenses issued for the export of arms, ammunition and implements of war were only $438,737. Except for $3,213, licenses were for commercial aircraft, parts and engines.

In contrast to the let-down in Japanese purchases, Chinese licensed expenditures rose to $2,809,099 of which $2,080,000 was for grenades, bombs and torpedoes and


VALLEY MOULD AND IRON CORPORATION
GENERAL OFFICE
HUBBARD, OHIO

$611,000 for ammunition for guns. Chinese purchases of American iron and steel remain small.

Russia also is increasing purchases for war supplies in the United States. This is indicated by the fact that in September Russia had obtained licenses for munitions valued at $10,057,920, of which $5,275,100 came under the classification of "vessels of war of all kinds, including aircraft carriers and submarines, and armor plate for such vessels."

While this does not mean the supplies actually were bought it is taken to signify that if negotiations are not completed Russia is preparing for the building of a battleship or battleships and is otherwise privileged to get war supplies in the United States. Other proposed Russian purchases licensed are $2,250,000 for guns, howitzers and mortars and $1,505,000 for ammunition for such weapons, $1,000,000 for propellant powders and $27,820 for commercial aircraft engines.

Russian purchases of American iron and steel have been light. In the first seven months of the present year they amounted to only 36,647 tons, of which 25,183 tons consisted of black steel sheets.

Navy Will Open Plate Bids Oct. 22

WASHINGTON, Oct. 12.—The Bureau of Supplies and Accounts, Navy Department, will open bids Oct. 22 for 358 tons of high tensile steel plates for the Washington Navy Yard and 165 tons of steel plates for the Norfolk, Va., Navy Yard. On Oct. 19 the bureau will open bids for 90 tons of sheets, plates, shapes and bars for the Charleston, S. C., Navy Yard.

Minority Craft Union Can Bargain Despite CIO, Labor Board Says

WASHINGTON, Oct. 12.—John L. Lewis and his industrial unionization drive suffered a minor set-back last week when the National Labor Relations Board ruled that a minority craft union may be a bargaining agent for employees within its jurisdiction even though the majority of the workers in a plant belong to a CIO union.

The case involved the Commonwealth Division of the General Steel Casting Corp., Granite City, Ill., where the board ordered an election be held before Oct. 21 to hear 450 welders, machinists, and pattern makers state their preference for either the AFL craft unions or the Amalgamated Association of Iron, Steel and Tin Workers, CIO affiliate.

Certification Delayed

Evidence previously submitted to the board and described by it as "satisfactory" indicated that the CIO union numbered 2100 members among the plants' 2450 workers. The union was about to be certified as constituting the majority collective bargaining unit, but certification has now been delayed "until the men in the smaller units have had an opportunity to decide whether they desire to join with the larger group." The board added:

"Such of the groups as do not choose the Amalgamated (CIO) will constitute separate and distinct appropriate (bargaining) units, and such as do choose the Amalgamated will, together with the balance of the production and maintenance workers, constitute a single appropriate unit."

At the same time the Labor Board announced recognition of the CIO's UAWA union as the exlusive collective bargaining agency for employees in the City Auto Stamping Co., of Toledo, where an election was held Sept. 8. The AFL polishers had asked that their group be considered a separate bargaining unit but the subsequent election, the board reported, showed a majority of the polishers favored CIO representation.

Two Suits Pending

Meanwhile, two injunction suits involving the Labor Board were pending on the Supreme Court docket when the Court convened on Oct. 4. In both cases the board has filed writs of certiorari asking review of lower court decisions.

One involves the decision of the First Circuit Court of Appeals (Boston) affirming the decree of the U. S. District Court for the District of Massachusetts granting a temporary injunction against the board, which restrains it from holding a hearing on charges of unfair labor practice brought against the Bethlehem Shipbuilding Corp.

The other seeks review of the decision made by the Circuit Court of Appeals for the Fourth Circuit (Richmond) which affirmed the decision of Judge Way of the Eastern District of Virginia denying an injunction against the board to prevent a hearing and other proceedings against the company.

With the volume of CIO requests before the board remaining at a high level, the Lewis organization is scrutinizing present trends within the board, which some view as indicative of a swing away from CIO bias, and is watching closely the current political situation like

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HAND MODEL

AXE MODEL

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any other group with avowed political aspirations.

Warn of Future

The latest blast on the political front to come from the CIO is the statement by Labor's Non-Partisan League, political mouthpiece of John Lewis, that the recent Detroit elections in which the CIO forces took a conspicuous part is only "a curtain raiser" for what may be expected in the 1938 elections. The League added:

"We consider the Detroit elections to be an indication of what can be done in every industrial city in America when labor is properly organized for political action."

NLRB Certifies SWOC In Petroleum Iron

WASHINGTON, Oct. 12.—The National Labor Relations Board has certified the Steel Workers Organizing Committee as collective bargaining agent for all employees of the Petroleum Iron Works Co., Hubbard, Ohio.

Supervisory and clerical employees, watchmen, and policemen, are not included in the bargaining unit. The board said it certified the SWOC following submission of union cards signed by 238 of the operating 300 employees.

The company has approximately 400 employees, of whom 100 are supervisory and clerical employees, watchmen and policemen. The NLRB said the company agreed to deal with the union as sole bargaining agent if the board determined that a majority of the employees supported the union.

Manganese Bids Sought By Navy

WASHINGTON, Oct. 12.—The Bureau of Supplies and Accounts, Navy Department, has asked for bids to be opened Oct. 29 for 24,000 gross tons of 40 per cent manganese ore and 8000 tons of 68-72 per cent ferromanganese for delivery to the Philadelphia Navy Yard.

The Navy Department has sent out two schedules, one for the ore and the other for the ferromanganese and reserves the right to make an award for either of the lots, indicating that it does not intend to buy both the ore and the ferromanganese. The manganese ore schedules ask for prices in 15,000, 18,000, 20,000, 21,000, 22,000 and 24,000 lots.

The ferromanganese specification follows: managanese, 68-72; carbon, 7.5; phosphorus, 0.32; sulphur, 0.05; silicon, 1; aluminum, 0.20; iron, remainder. Delivery was asked for in 180 days but bids for a greater time for delivery may be submitted and will be considered.

Tire Price-Fixing Data Goes To FTC

WASHINGTON, Oct. 12.—In line with Secretary Ickes' frequent complaints against collusive bidding on sheet piling for PWA projects, the Treasury Department has referred to the Department of Justice and the FTC evidence alleging that 14 prominent rubber companies bid "identical prices to the cent" on a wide variety of automobile tires and tubes.

The action was taken after the Treasury Department was assured by Attorney General Homer S. Cummings that "the conclusion was justified" that the bids were the result of "collusive action" and of a "combination in restraint of trade."

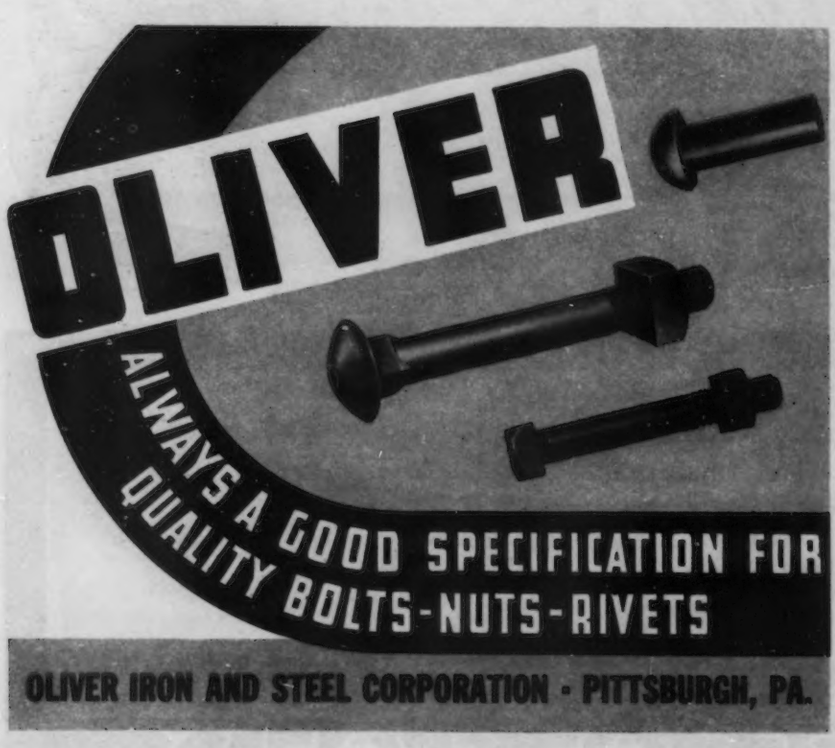
At the same time the Treasury's Procurement Division announced it had awarded the Government's $1,000,000 tire contract for the next six months to Sears, Roebuck & Co., the concern involved in the action taken in March, 1936, against the Goodyear Tire & Rubber Co. on the FTC charges that "price discrimination," amounting to as much as a 53 per cent reduction in tires supplied to the mail order firm, was driving the small dealers out of business. Goodyear announced last summer it had discontinued the Sears' contract in view of the Robinson-Patman Act.

Argentine Orders May Come To U. S.

ARGENTINA remains an attractive market for iron and steel products despite the drop in 1936 imports against 1935, according to reports received by the Metals and Minerals Division, Bureau of Foreign and Domestic Commerce from Trade Commissioner A. Cyril Crilley, of Buenos Aires.

Imports of iron and steel items into the Argentine during 1936, consisting mostly of bars, sheets, plates, wire, rails, pipe and foundry ingots, totaled approximately 543,000 metric tons, valued at 82,740,848 pesos against 575,000 tons valued at 88,936,638 pesos in 1935.

During early 1937 most of Argentina's steel requirements were met by Belgium-Luxembourg, Germany, England, Poland, France and the United States. Strong domestic demand in Europe has lifted prices offered the Argentine market which reports low stocks, hence prospects for placing of steel orders in the United States are brightening.



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The economies of grouping a number of operations on one machine in a single set-up are no longer limited to jobs which are big enough in themselves to pay for a special machine.

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Identical Bidding In Steel, Other Industries Again Cummings Target

WASHINGTON, Oct. 12.—Though sharply challenged by industry, the Roosevelt Administration sticks to its often-expressed view that identical bidding means a lack of competition. The Administration is insistent that something be done about it, preferably by overhauling the anti-trust laws.

The Administration attitude was again touched on last Wednesday by Attorney-General Cummings at a press conference. He repeated his recommendation, made last April in a letter to President Roosevelt in connection with steel bids, that a commission be set up to study the anti-trust laws for the purpose of strengthening them. One of the prime purposes is to prevent identical bidding. The widespread implication of such a step is apparent.

Steel and numerous other industries together with consuming industries are built up on methods of price quotation that often produce identical delivered prices.

In steel, and other industries making heavy and like commodities, the multiple basing point system prevails. Most distinctly they insist that they maintain a competitive system, and that by no means do identical prices signify a lack of competition. On the contrary, they have repeatedly pointed out to different Government branches and officials such as the Federal Trade Commission, Congressional committees, and Secretary of the Interior Harold L. Ickes that competition, and not collusion, is reflected in identical bids.

If, for instance, A is in the market for steel, the delivered price is made up of two factors: The basing point price at B, the mill nearest to A's plant, plus the freight rate to destination. If C, the more distant mill, is to compete, it must quote f.o.b. B, plus the freight rate to A, C absorbing the freight differential, thus selling on a C-minus basis. C could not compete if it quoted on its own base. Assuming the absence of C or any other competitor, B would control the market and, therefore, be in a position to quote a higher price because of no competition at the hands of a more distant mill.

Cummings Less Arbitrary

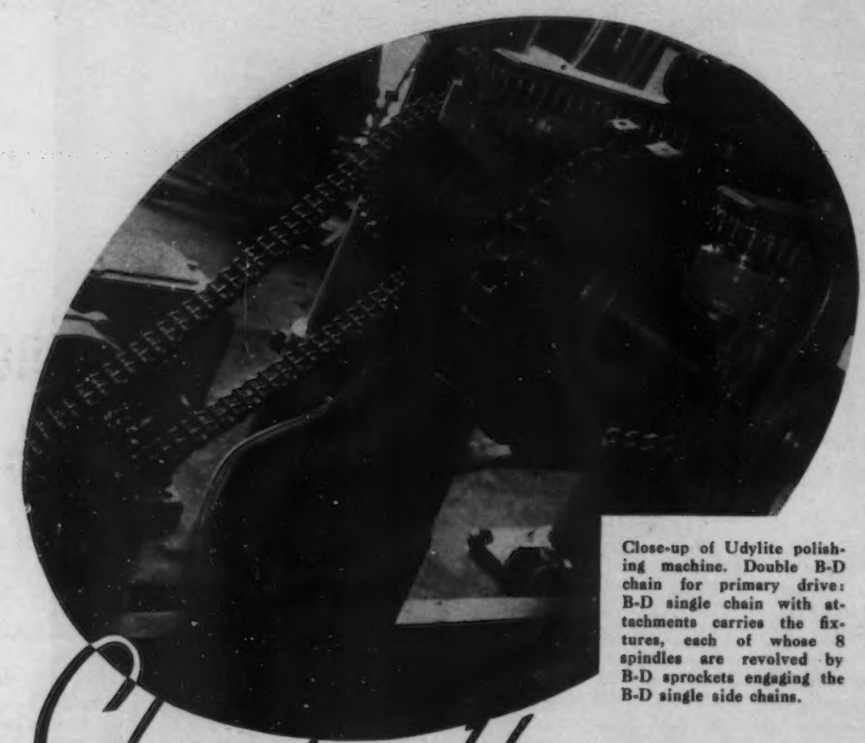
The Department of Justice, as indicated by remarks of Mr. Cummings, while striking at identical bidding and urging the necessity of revision of the anti-trust laws, does, nevertheless, show a comprehension of the basing point system that causes it to take a less arbitrary and more cautious attitude toward it than do other Government sources, such as the Federal Trade Commission, which now is engaged on cases seeking to do away with that system and to substitute an f.o.b. mill basis of quotation.

Precisely what Mr. Cummings has in mind to wipe out identical bids has not been announced by him. Perhaps he has no definite objective and feels it cannot be determined until the proposed commission to study anti-trust law revision has been set up and reported its findings. It is contemplated that, if set up, the commission would hold hearings.

Mr. Cummings, discussing identical bidding, said:

"The mere presence of identical bids is not prima facie evidence that anything is wrong."

Commenting on the extended Ickes-inspired investigation made on sheet piling for PWA projects last year, the Attorney-General conceded that the Department of Justice could get no evidence of



Close-up of Udylite polishing machine. Double B-D chain for primary drive: B-D single chain with attachments carries the fixtures, each of whose 8 spindles are revolved by B-D sprockets engaging the B-D single side chains.

Cleaning Up WITH
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Suppose you had to clean and polish 16,000 lamp sockets, door knobs or other similar items an hour? This new Udylite polishing machine could do it for you economically, in part because of the generous use of 3 different types and sizes of Baldwin-Duckworth roller chain; and over 100 Baldwin-Duckworth accurate-cut sprockets. When you want to "clean up" on production costs, there's a good chance the best answer is the right Baldwin-Duckworth roller chain. Consult our engineering department for a detailed analysis of your particular job. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

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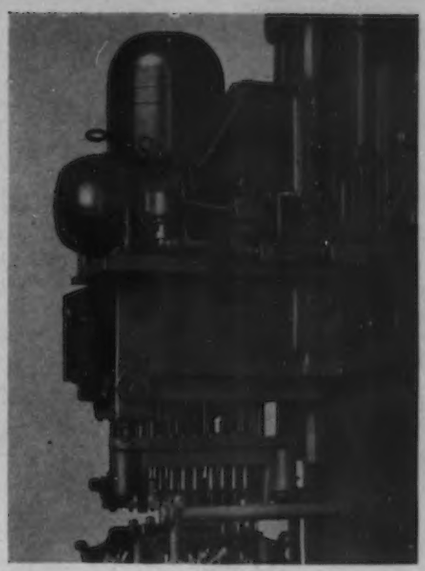

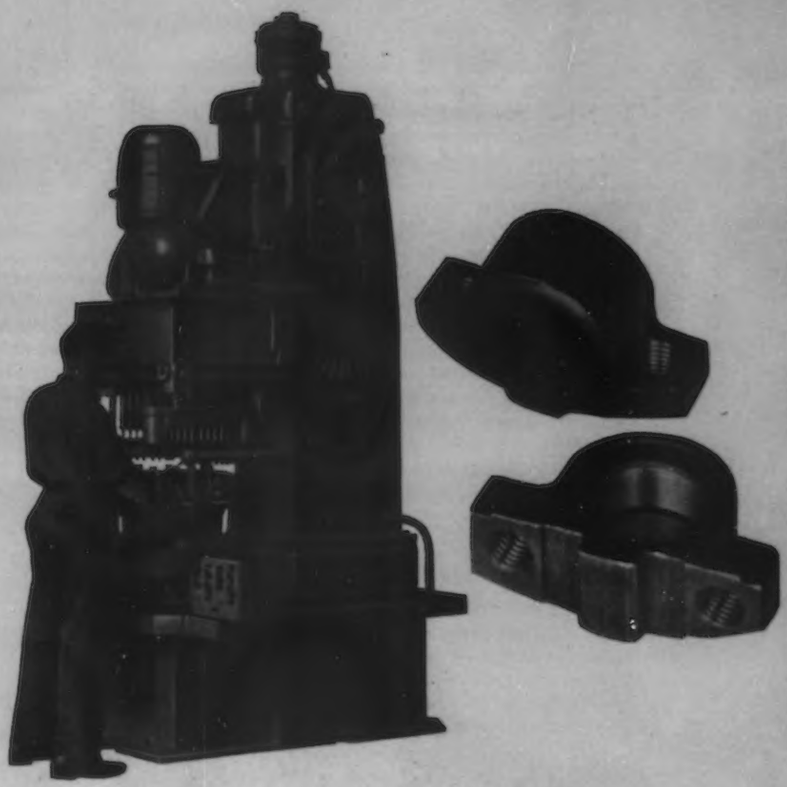

400 Steel Trunnion Bearings Drilled, C'sunk and Tapped Per Hour

This NATCO Vertical HOLESTEEL Combination Driller and Tapper is drilling, countersinking and tapping two 5/16" diameter holes in each of 400 Steel Trunnion Bearings per hour. Shown directly above is the auxiliary individual lead screw tapping unit mounted on the drilling head.

Combine Drilling, Countersinking and Tapping Operations on a NATCO HOLESTEEL Machine

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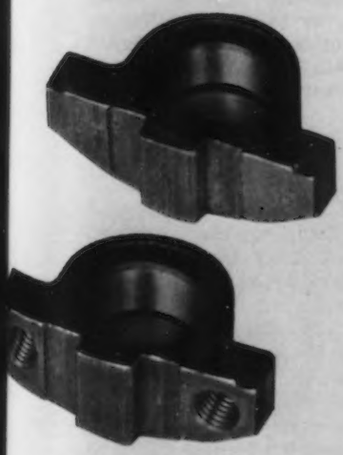

Shown above is one of the new NATCO Vertical HOLESTEEL hydraulic feed machines which is being used by a prominent automobile manufacturer. It is drilling, countersinking and Tapping two 5/16" diameter holes in 400 small Steel Trunnion Bearings per hour.

This machine is arranged with a fixed center spindle box containing a total of 16 drilling spindles and 8 tapping spindles. The tapping spindles are driven by an auxiliary reversing motor drive tapping unit mounted on the head proper. Mounted on the high steel base is a four position fixture arranged to hold four "Trunnion Bearings" in each position. As the parts are indexed from one position to another the required operations are performed.

Combining these operations on one standard NATCO Vertical HOLESTEEL machine has enabled this manufacturer to obtain accurate drilling, countersinking and tapping . . . on a high prodution basis with remarkable efficiency.

This machine was built for a particular set of operations and ordinarily would be considered special equipment . . . yet it is built of standard NATCO machine elements which are flexible and interchangeable. NATCO Vertical HOLESTEEL Hydraulic Feed Machines are built in a variety of sizes and capacities. Investigate them today. Call a NATCO representative today and let him aid you in coming to a practical and profitable solution of your "hole" problems.

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Drilling, Boring and Tapping Machines

collusion and said the inquiry convinced him that no prosecution could be conducted under present laws. The inference appeared to be that under revised laws identical bidding could be prohibited—though exactly how it could be stopped was not indicated—and that prosecution could be instituted.

The Attorney-General again taking a broader vision of the basing point system than other Administration sources take, also said he realized that purchasing groups had been built around industries using the system and that its sudden elimination would be most disruptive to both the producing and consuming industries and their employees.

Must Produce Evidence

Yet in the face of this position the Attorney-General blamed the basing point as an essential factor in what he said was the increase in the practice of identical bids for Government contracts.

It is assumed he had this long-established system in mind when he said:

"The day is long past when bidders sit around a table and agree on a price.

"The problem is much more complicated than that. Nowadays you must produce evidence of a collusive arrangement."

Mr. Cummings complained of "emasculation of anti-trust laws through various judicial interpretations" as he pleaded for a "serious study of the anti-trust structure." The Attorney General did not say what particular "emasculation" he had in mind. However, it may or may not be pertinent to point out that the Supreme Court of the United States has upheld the multiple basing point system and it is probable that this decision shares consideration in connection with the demand for a revision of the anti-trust laws.

Talk of revision of the anti-trust laws is about as old as the anti-trust laws themselves.

Wilson Sought Change

In 1908 Woodrow Wilson suggested revision of the anti-trust laws. But his purpose was for their simplification and clarification. Said Mr. Wilson:

"We have passed laws forbidding such combinations and such practices as would virtually constitute monopolies and have attempted to enforce them . . . . .

"Government control, which we are undertaking so extensively and with so light a heart, sets up not a reign of law, but a reign of discretion and individual judgment on the part of Governmental officials in the regulation of the business of stock companies owned by innumerable private individuals and supplying the chief investment of thousands of communities.

"I can see no radical difference in principle between Governmental ownership and Governmental regulation of this discretionary kind. Regulation by commission is not regulation by law, but control according to the discretion of Governmental officials. Regulation by law is judicial, by fixed and definite rule, whereas regulation by commission is an affair of business sense, of the comprehension and thorough understanding of complex and various bodies of business. There is no logical stopping place between that and the actual conduct of business enterprises by the Government.

"Such methods of regulation, it may be safely predicted, will sooner or later be completely discredited by experience."

Find Acts Conflict

Many lawyers and industrialists alike are in accord with the view that if the country is to get out of the present statutory mess the Government must write plain prohibition against particular practices and have the Court enforce suits of any person damaged by violation of the act. It is also the view of many that many sections of the various anti-trust acts are contradictory, conflicting, too rigid in some respects, trade restraining in other respects, impracticable and unenforceable in some instances.

The Government under the New Deal has kicked the anti-trust laws about more than any group of private industry could possibly do. And it is due to the Supreme Court that the strength of the laws has been revived, notably in the NRA and AAA decisions. Still there is talk of New Deal trade practice legislation, with its anti-trust immunizing bath. There is the Tydings resale price law. There is the Guffey coal act. Each was given the New Deal o. k. despite the affected reluctance with which the President signed the former.

Restore Competition

The central idea the Department of Justice affects to have in mind in revision of the anti-trust laws is for the "restoration" of competition. For, as pointed out, it is insisted competition is disappearing as indicated by identical bidding and by other means. This attitude in the face of New Deal laws restraining or eliminating competition has a heavy strain of irony in it.

Robert H. Jackson, Assistant Attorney General, in charge of trust busting, probably reflected the Administration view on anti-trust law revision in a speech he delivered Sept. 17 before the Trade and Commerce Bar Association and Trade Association Executives in New York, although he specifically admonished that his opinions should not be attributed to the Department of Justice or the Administration.

Lists Conclusions

He said that as a result of confusion over anti-trust laws and Court decisions regarding them, "we are faced with the following inescapable facts:

"1. The Department of Justice has no satisfactory standards by which cases can be selected for prosecution or by which the success of any given prosecution may be predicted with assurance.

"2. Business enterprise has no safe standards by which it may determine in advance the validity of concerted action, even when the principal purpose is to eliminate waste, or reduce costs of production or distribution.

"3. The administrative arm of the Government is unable to give commitments as to any combination, because the confusion of precedents and policy is such that a position taken in one case may prove an embarrassment in others."

Mr. Jackson said: "American business must make up its mind whether it favors the regulation by competition contemplated by our anti-trust laws, or the only probable alternative—Government control. Every step to weaken anti-trust laws or to suspend them in any field, or to permit price fixing, is a certain, even if unknowing, step to Government control."

Chicago Holds Power Exhibit

MORE than 150 companies from 31 states will exhibit their products and machinery at Chicago's first power show being held this week in the International Amphitheater. Ten thousand engineers and buyers are expected to attend the show, officially known as the Chicago Exposition of Power and Mechanical Engineering.

The exposition will observe the forty-eighth anniversary of the introduction of diesel power in the United States, and the latest development in diesel engines and applications of diesel power will be shown. Air conditioning and industrial safety exhibits also will be featured.

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Choice of Steel It is important to select the correct grade of stainless steel for maximum satisfaction in every application. In recent years, Ludlum has developed a wide range of Silcrome Stainless Steels in special analyses to meet the increasingly varied requirements of modern design and such problems as machining, welding, forging and heat treatment in modern metal working operations. With the aid of Ludlum service you can now select the most suitable grade of Silcrome Stainless Steel with respect to such factors as heat and corrosion resistance, wear resistance, and the various phases of metal working, including machining, cutting, forming, welding, and the like. Each grade is available in all forms, including bars, billets, sheets, plates, strip, wire; also in castings from two pounds to a ton.

Tools Another fundamental factor in deriving maximum profit from the use of stainless steel is the proper choice of tool steels for efficient and economical production. Ludlum has accompanied its development of Silcrome Stainless Steel with the production of improved tool steels especially adapted for the working of all grades of Silcrome. Extensive tests by Ludlum engineers in the laboratory and under actual working conditions enable sound recommendations of the most effective types, shapes, and speeds for drills, saws, punches, taps, and other tools used in machining and in other metal working and finishing operations. In addition to the services of its sales engineers and metallurgists, Ludlum offers data on the physical properties of its various tool and stainless steels in the form of the famous Ludlum Blue Sheets.

Working Methods Aid to Ludlum customers in the determination of more satisfactory and profitable working methods is the fourth fundamental phase of Ludlum Service to users of Silcrome Stainless Steel. With correct design, the right grade of Silcrome, tools of proper grade, hardness and finish for working operations there remains the combination of these factors in the working method or process itself. To round out its service, Ludlum has carefully compiled a new master Blue Sheet or brochure entitled, "The Working of Silcrome Stainless Steel." This new book is illustrated and described on the opposite page. We believe it will prove to be a worthwhile contribution and that it will help increase the profits derived from the specification and use of Silcrome.

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GET THESE TWO BOOKS FREE

New Ways to Increase Sales and Profits with Silcrome

The use of Silcrome Stainless Steel faces a bright and promising future because of the many advantages it affords to manufacturers in countless fields. Experience has shown that its adoption usually brings increased sales and profits to its users. With the hope of pointing the way to new opportunities for industry, an attractive and interesting booklet has been prepared, "New Ways to Increase Sales and Profits with Silcrome Stainless Steel." This 32-page booklet is easy to read and easy to look at. There are 107 striking illustrations of the many products now made of Silcrome. We believe you will find in it practical and profitable suggestions.

The Working of Silcrome Stainless Steel

A more detailed booklet has been prepared for the use of engineers, designers, and technical men interested in practical working methods. "The Working of Silcrome Stainless Steel" is a factual data book prepared by Ludlum engineers to help Ludlum customers use Silcrome to greatest advantage. Starting with a discussion of machining, this new data book provides practical advice and suggestions on all the common metal working operations, including sawing, drilling, milling, threading, and tapping; cold and hot upsetting and forging; forming, shearing, drawing, punching, spinning, brazing, soldering, and welding. Correct tool steels for the various operations are also discussed. This information is the result of constant experimentation in the laboratory and close observation of actual production methods. Behind it is the accumulated knowledge gained through 83 years of fine steel making. Send for your copy of this new booklet today. Just check and mail the coupon.

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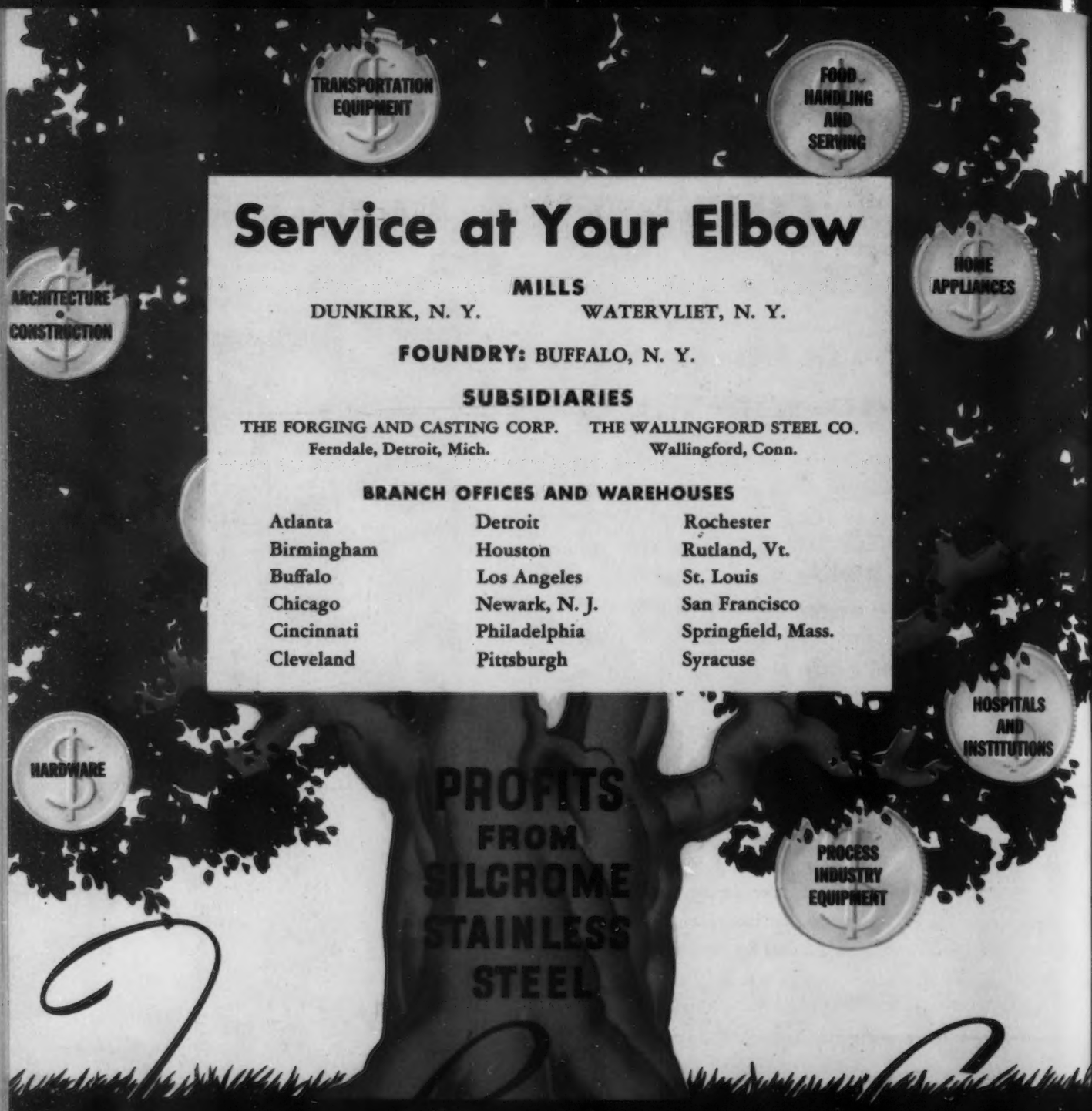

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Cleveland	Pittsburgh	Syracuse

MAKE SURE THE ROOTS ARE STRONG··WELL NOURISHED

S. L. NICHOLSON was recently elected honorary life member of the American Gear Manufacturers' Association, of which he was one of the founders. A few months ago he retired, after long service, as assistant to the vice-president of the Westinghouse Electric & Mfg. Co.

◆ ◆ ◆

H. SIDNEY SMITH, consulting engineer, Prest-O-Lite Co., Inc., New

S. L. NICHOLSON

York, has been given the Samuel Wylie Miller Medal, awarded annually by the American Welding Society "for meritorious achievement contributing conspicuously to the advancement of the art of welding and cutting." For many years Mr. Smith and the late S. W. Miller were closely associated in their technical, business and engineering society activities.

Mr. Smith has served as president of both the British Acetylene Association (1910) and the International Acetylene Association (1920), and has been directly responsible for many important developments in acetylene utilization. He was born in Newark, England, and educated as an electrical engineer at Nottingham University. In 1898 he joined the Acetylene Illuminating Co., Ltd., where, in conjunction with S. G. Worth, he turned out the first calcium carbide made in Great Britain on a commercial scale. In 1901 Mr. Smith began experimenting with the use of dissolved acetylene and also with oxy-acetylene welding. Use of dissolved acetylene was sanctioned by the British Home Office largely as the result of these experiments.

In 1911 he came to America and joined the Prest-O-Lite Co., Inc., at Indianapolis, becoming works manager in charge of all gas plants, and in 1918 became consulting engineer for the Union Carbide Co.

Mr. Smith has been the author of a large number of technical articles and wrote one of the first instruction manuals on oxy-acetylene welding and cutting. He contributed significantly to industrial safety and fire prevention, especially in regard to the transportation and use of industrial gases and the use of the oxy-acetylene process. He has worked actively with insurance and regulatory bodies in developing and applying rules and procedures to improve the safety standards of the industry.

In 1928 Mr. Smith was elected president of the Compressed Gas Manufacturers' Association and for many years has been a director and a member of the executive committee of the American Welding Society. He is also an active member of a number of other engineering societies.

◆ ◆ ◆

N. D. CARPENTER, formerly of the West Leechburg Steel Co., and the Superior Steel Co., has been appointed special representative of the strip steel sales division of the Weirton Steel Co., Weirton, W. Va.

◆ ◆ ◆

RALPH L. WILSON, formerly metallurgical engineer of the Timken Steel & Tube division of the Timken Roller Bearing Co., Canton, Ohio, has become associated with the Climax Molybdenum Co., New York, as metallurgical engineer in its development field. After his graduation from Lehigh University in 1921, Mr. Wilson served on the metallurgical staff of the United Alloy Steel Corp. and its successors, the Central Alloy Steel Corp., until 1928. He then was appointed assistant metallurgical engineer of the Timken Steel & Tube Co., becoming metallurgical engineer in 1933. Mr. Wilson will make his headquarters at the Canton office of the Climax Molybdenum Co., where he will devote much of his time to development work on steels for elevated temperature service.

◆ ◆ ◆

F. B. LOCKHART has resigned as a vice-president and director of the Hillman Coal & Coke Co., Pittsburgh, but for the present will continue his former duties with the company.

◆ ◆ ◆

F. M. MAICHLE, heretofore manager of the Pittsburgh office of the Lincoln Electric Co., Cleveland, has been made manager of its Detroit office. He studied at the

L. T. BEECHER (above), who retired on Oct. 1 as secretary-treasurer of the Tennessee Coal, Iron & Railroad Co., and C. R. Sexton, new secretary-treasurer, as announced in these columns last week.

United States Naval Academy, and from 1916 to 1928 served the Government as a naval officer. Prior to joining the Lincoln organization, Mr. Maichle was sales engineer for a steel company.

◆ ◆ ◆

R. R. LAPELLE, formerly associated with the Westinghouse Electric & Mfg. Co., in charge of the industrial heating engineering division, Salem Engineering Co., Salem, Ohio, and Philadelphia Drying Machine Co., Philadelphia, has joined the staff of the Gas

Machinery Co., Cleveland, as a furnace engineer.

❖ ❖ ❖

IRWIN P. RIEGER has been appointed district manager of sales in the Chicago district for the Standard Tube Co., Detroit. He is a graduate of Northwestern University and has been identified with the steel industry for a number of years. A. R. SCHUMANN, formerly purchasing agent of the company, has been transferred to the sales department.

❖ ❖ ❖

E. F. WEISS, who has been identified with Cutler-Hammer, Inc., Milwaukee, since his graduation from Carnegie Institute of Technology in 1922, has been made manager of the company's Detroit office, succeeding A. R. JOHNSON, who recently became manager of the company's merchandising sales division. E. T. REES, who has had over 25 years' experience in the electrical engineering sales field, has been appointed manager of the Indianapolis, Ind., office. F. J. WOLDRICH, since 1933 associated with the Cutler-Hammer sales staff, has been placed in charge of the newly opened branch office in Portland, Ore. He received his formal education at the University of Portland, Northwestern School of Commerce and the University of Oregon.

❖ ❖ ❖

BONNELL W. CLARK, heretofore vice-president and general manager of the Westinghouse Electric Supply Co., New York, has been elected president of the company.

FREDERICK D. BENZ, formerly manager of the wire sales department, Chicago branch, United States Rubber Products, Inc., has been appointed district manager of wire sales, Pacific division, with headquarters at San Francisco.

❖ ❖ ❖

ROBERT C. MOSS has been appointed manager of sales for American Steel Foundries, Verona, Pa. He was formerly manager of the company's Newark works.

❖ ❖ ❖

FRED PERKINS has been named superintendent of the locomotive shops of the Grand Trunk Western Railroad at Battle Creek. Formerly he was general machine shop foreman. He succeeds M. HARRY WESTBROOK, who retired from the position, which he had held with Grand Trunk since 1919.

❖ ❖ ❖

B. D. MCINTYRE has been elected president and general manager of the Monroe Auto Equipment Co., succeeding his father, C. S. MCINTYRE, whose death was reported in *The Iron Age* on Sept. 16. Two of the new president's brothers, WILLIAM and CHARLES, JR., are directors of the equipment manufacturing business established in 1917 by their father.

❖ ❖ ❖

M. F. MAY, formerly sales manager of the catalog products division, Young Radiator Co., Racine, Wis., has been appointed vice-president by F. M. Young, president. Mr. May will continue to direct the sales activities of the catalog products division.

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The speed and safety of Blanchard Grinding are especially important on die work.
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If you use dies, we suggest that you send us one or two and then either come to our factory and see them ground or let us submit to you the data on the Blanchard Grinding operation.
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Blaw-Knox Sells 400 Radio Towers

THE United States Department of Commerce has awarded a $350,000 contract to the Blaw-Knox Co., of Pittsburgh, for 400 radio-range towers to guide airplane pilots.

The stations consist of a group of four towers in a square with a fifth in the center, all about 135 ft. high, with the outside towers transmitting a beam course and the center tower transmitting weather reports and other information without interruption of the beam signals.

Of towers to be erected about half will be used to modernize or relocate existing stations and 44 five-tower stations will be erected at various points throughout the country.

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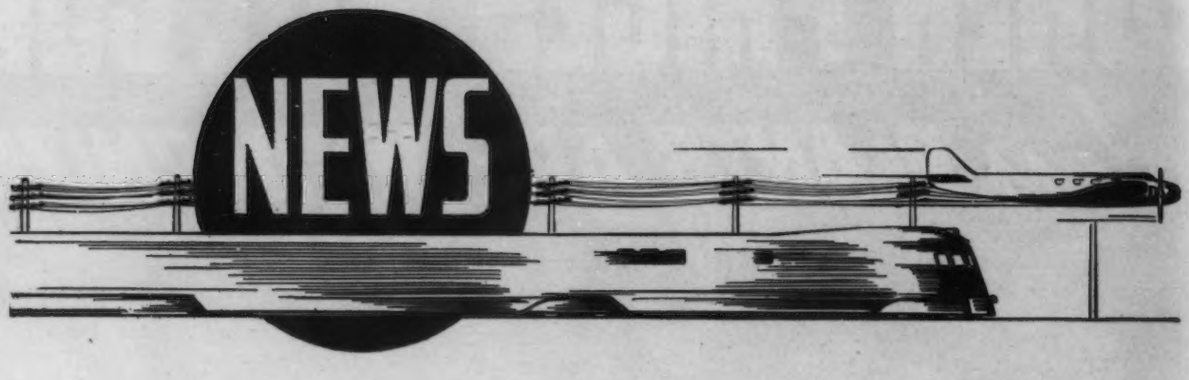

Russia Buying Machinery to Launch Third Five-Year Plan

RECENT heavy purchases of machine tools and other manufacturing equipment by Russian sources is in preparation for the third Five-Year Plan, which covers the period 1938 to 1942 inclusive. An increasing tempo of industrialization is calling for more machines to make machines. Russia still depends upon the United States for the largest bulk of machinery imported, and apparently will continue to place orders here, despite the fact that Russia herself is now exporting machine tools to Poland, Holland and Iran. Exports of machine tools and lathes from Russia rose 165 per cent in 1936 over the 1935 figures.

Now that the second plan is nearing its end, one of the big objectives is the reconstruction and enlargement of the big automobile undertakings that had gone into production at the beginning of the plan. Outstanding among these is the Molotov plant in Gorky, which after its reconstruction will have a capacity of 500,000 automobiles a year, of which 400,000 will be 1½-ton trucks, the remainder passenger cars. Another plant to be enlarged is the Stalin plant in Moscow, which is being revamped to bring up its capacity to 100,000 3-ton trucks and 20,000 large 8-cylinder passenger cars annually. Next year the Gorky plant will begin to produce a 6-cylinder passenger car of improved type.

The Soviets' three tractor plants have met the demands of agriculture thus far, but new production is planned. The third Five-Year Plan calls for 120,000 caterpillar tractors a year, 40,000 of which are to be equipped with diesel power. Special emphasis is to be placed on the quality of production. The industry will also give its attention to the utilization of gas fuels on a large scale. The plan also calls for some thousands of buses of all-metal metropolitan type.

Motor Transport Development

Hand in hand with this manufacturing program will be the wide scale development of motor transport. This, together with the extension of air lines, will lessen the need for extensive construction of new railway lines to outlying parts of the country, involving much greater capital outlays. Already, motor roads have played a prominent part in the development of Eastern Siberia and the Far East. The plan also provides for an increasing number of trucks and tractors to be placed at the disposal of State and collective farms for the transport of agricultural products to existing railways.

This does not imply that railroad activity is to be neglected. Special attention is to be paid to improving traffic control and perfecting rolling stock. Russia is now producing both locomotives and freight and passenger cars. Wider use is to be made of locomotives with tender-condensers, of automatic coupling and automatic block signalling.

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New Type ELWELL·PARKER *Trucks*

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Direct transfer of shipments from motor truck to railway truck is to be further developed.

Water transport is also to share in the general plan, largely with the object of opening navigation on the vast system of small rivers, for which thousands of boats of shallow draft are to be constructed. New investments are also to be made in sea-going and river ships of much larger capacity and speed. Loading and unloading operations will be further mechanized.

Having already built up a huge military air fleet, the Soviets expect by 1942 to occupy a leading place in civil aviation also. All passenger and mail planes now in use are to be replaced by high-speed machines, including six-engined multi-seater planes of the Maxim Gorky type. High power planes are to be built for freight transportation. The length of main airlines will be increased by some 30,000 km., bringing the total to 85,000 km. Local lines connecting the provinces and the chief towns of the different republics will be increased to 60,000 km.

More Tools Will Be Needed

All this proposed activity in automotive and transportation lines will depend to a great extent on precision machine tools, and from orders recently placed it is apparent that much of this equipment will be supplied by the United States. Great Britain has always been an important source too, but is greatly absorbed in its own domestic market. In this connection, it is interesting to note that on very recent machine tool orders placed in the United States, delivery is specified all through 1938 and well into 1939.

A great deal of heavy-duty machinery is being bought here that will undoubtedly go to build up the heavy industries in the U.S.R.R. Extensive development of mineral and metal resources is planned. The development of new oil fields in the Eastern and Central districts will be a main feature of the third plan. Output is expected to be increased four fold. Prospecting is to be aided by the use of internal combustion engines instead of electric motors for drilling. Drilling for gas is also to be pushed. Large scale mining of oil bearing shale is planned. By the end of 1942, preliminary estimates place the annual output at 9,600,000 tons, as against 800,000 in 1937. This increase will be based on the construction of mines and plants. New power stations are to be built to run on shale fuels.

Mine Output To Be Increased

Mining and smelting of copper, lead, zinc and other metals is to be doubled or trebled. Toward the end of the third plan, the center of the copper industry will be Kazakhstan, which will then provide about 70 per cent of the copper output. The Balkhash Copper Smelting Combine, the largest in Europe, will be completed there, with a projected annual capacity of 100,000 tons of copper. A new copper combine being built at the copper ore deposits at Jezkazgan will have its first section completed in 1940 and will eventually have a planned capacity of 200,000 tons annually. The mining of copper ore is expected to reach 42,000,000 tons by 1942 — nearly five times that of 1937.

Electrolytic production of zinc is to be developed in Northern Caucasus. Gold production is also to be pushed. Electric locomotives, cable transporters and conveyors are to be used in the transport of ore. The engineering plants in Krasnoyarsk and Irkutsk are concentrating on the production of dredges, excavators and smaller equipment. Research is being carried on in connection with the problem of extraction of gold and other metals.

Saginaw Stamping & Tool Co., Saginaw, Mich., announces development of a new self-alining third wheel knee-action caster unit, designed to relieve a trailer tow car of all excessive loads, allow easy maneuvering of the trailer while traveling and eliminate jack-knifing and side-swiping at any speed.

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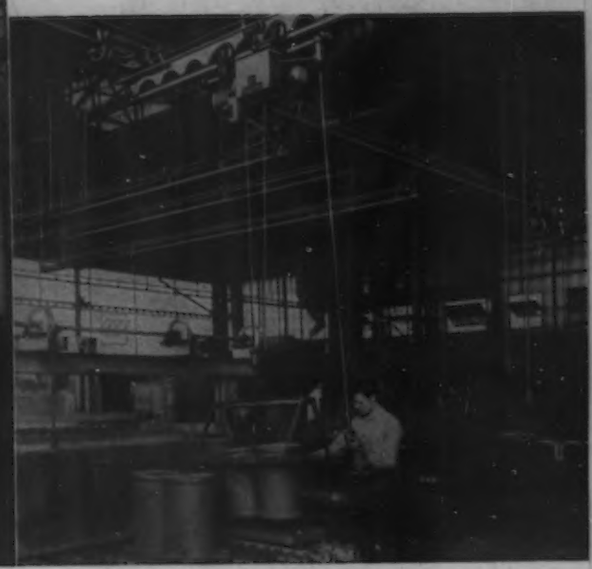

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WICKLIFFE OHIO

Coal Company Mergers Advised By Koppers Official To Aid Industry

PITTSBURGH, Oct. 12.—Mergers of the nation's soft coal producers into five or six large companies would soon bring a large measure of stabilization to the coal industry, J. P. Williams, Jr., Koppers Coal Co., president, said here.

Speaking before more than 500 operators from every bituminous coal producing area in the country meeting here last week, Mr. Williams urged a fair trial of the bituminous coal act and praised regional marketing agencies as a road to stabilization. As to difficulties in prices, Mr. Williams said:

"Why is it so difficult to reach a stable price basis in the bituminous coal industry? To my mind it is due to the great number of units or companies in the industry, most of which have their entire investment in one field and are restricted in their markets by competition from other fields and by a hodgepodge of freight rates."

Proposes Mergers

"The easiest answer to this is through mergers into large companies, with properties in each of the major fields, so that they can reach all markets. Five or six such companies controlling 250,000,000 to 300,000,000 tons of production could soon bring a large measure of stabilization. Their management would have a national viewpoint, not a sectional one."

Charles F. Hosford, Jr., chairman of the National Bituminous Coal Commission, reviewed the coal industry from various angles such as human relations, the coal consumer and the matter of public relations. He also reaffirmed his unwavering belief in the principle of industry self-government.

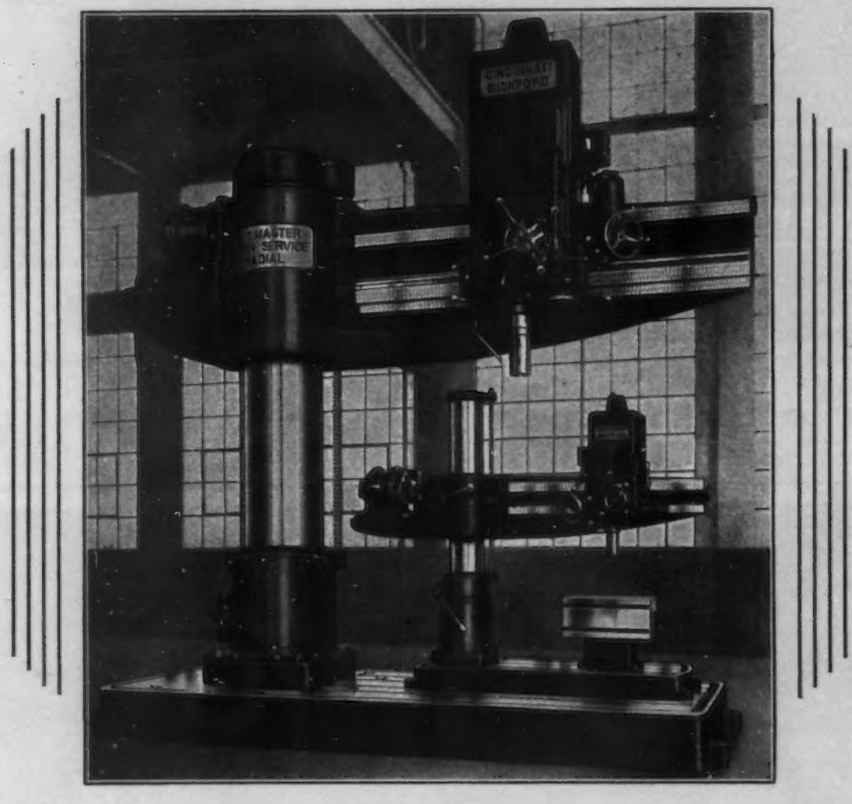
In commenting on intervention of the Government into private business, Mr. Hosford said, "I do not believe that it is the function of Government to intervene in private business except when and where the public interest inescapably requires such action, but from the record, where can be found a more clear-cut case of inability to govern itself than we find in the coal industry, and the inevitable consequence has been the enactment of a regulatory law."

Industry Needs Spokesman

"The bituminous coal industry will ever need a spokesman and public defender," he said. "In some matters the National Bituminous Coal Commission can now serve in that capacity, but in others the law itself limits the scope of our operation. It is a most difficult task to convince coal producers that their problems are more than local in character.

"From my experience of the past two years in Washington alone, I am convinced that the problems of the coal producer of Alabama clearly resemble those of the producer in the State of Washington. Ohio and Pennsylvania may find their problems differing in degree, but fundamentally the causes of our present difficulties are the same and their solution is to be found in a common answer."

Mr. Hosford outlined difficulties of the new Bituminous Coal Commission, indicating that every effort would be made to establish



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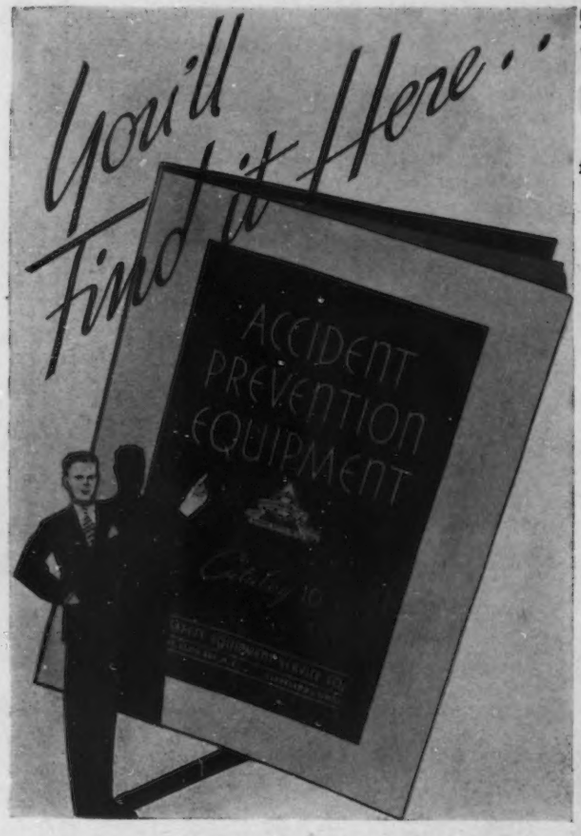
price schedules by Nov. 1 although many attending the annual meeting believed final agreements would not be reached until a later date.

Hits Surplus Tax

Fred H. Clausen, president, Van Brunt Mfg. Co., Horicon, Wis., discussed present Federal taxation in its relation to business enterprise and arraigned the graduated surtax on undistributed corporate earnings as blockading business progress.

J. E. Martin, of the Stoker Manufacturers Association of Chicago, urged a close alliance between the producers of bituminous coal and the manufacturers and distributers of automatic coal burning equipment to meet the competition of other fuels in the domestic heating field.

At the concluding session the National Coal Association reaffirmed its opposition to the principle of Government ownership of railroads, approved market promotion campaigns on the wider use of bituminous coal, reaffirmed its opposition to the entry of the Federal Government into the generation and sale of hydro-electric power, and directed that the committee on public and Government relations study and submit its conclusions with respect to proposals and suggestions concerning shorter working time to the end that a policy might be developed on the whole subject from a standpoint of efficiency, economy and fairness to employers and employees.



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NLRB Admits Data On Johnstown Body

PITTSBURGH, Oct. 12.—Despite repeated objections from Bethlehem Steel Co.'s counsel, testimony concerning the Citizens' Committee of Johnstown, including names of contributors, was put into the record yesterday at the National Labor Relations Board hearing at Johnstown, location of Bethlehem's Cambria Works.

Company counsel held the testimony had no bearing on charges of Wagner Act violations against Bethlehem Steel Co. The Citizens' Committee was formed during a Steel Workers Organizing Committee strike last June when attempts were made by the union to keep workmen from returning to their jobs.

The NLRB's hearing on charges against Weirton Steel has entered its eighth week with the board's witnesses still being heard. Clashes between company counsel and the board's lawyers are becoming more bitter each week owing to controversy over admissibility of hearsay evidence.

Bone of contention last week was refusal of SWOC officers to disclose the number of union members at the Weirton Steel Co. plants. The steel company's counsel contended that the SWOC cannot prove it has a legitimate complaint unless it is established that a union membership exists among Weirton employees.

The NLRB trial examiner overruled attempts to force the SWOC to disclose its membership. Most of the testimony yesterday involved questioning of an officer of the Weirton Employees' Security League concerning the publication of a so-called "honor list" which branded several current labor leaders, including John L. Lewis, as Communists.

Farm Industry Again Prosperous, Implement Manufacturers Told

FARMING again stands out as the nation's largest and one of its most prosperous industries, H. G. Davis, director of research, Farm Equipment Institute, declared before the institute's 44th annual convention at Chicago.

Crops are good and prices are about 18 points higher than in the corresponding period of 1936, while cash income from marketings of farm products so far this year has been about 12 per cent higher than in the same period last year, Mr. Davis said.

Government payments for the first eight months of this year were also higher, 142 million dollars more leaving Federal coffers than in the first eight months of 1936. Farm equipment sales and farm income go hand in hand and the industry is enjoying the best business since 1929, he added.

To show the relationship between farm income and sales of farm machinery, Mr. Davis used charts and graphs, one of which brought out that at the low point of 1932, farm income was 41 per cent of 1929, non-agricultural income was 63 per cent, and machinery sales only 21 per cent of 1929.

Cuts Farm Sales

"Decline in farm income appears to drag down non-agricultural income," said Mr. Davis, "and it pushes down farm equipment sales." In 1929, farmers spent 4.9 per cent of their income for machinery while in 1932, when income was only 41 per cent as great as in 1929, they spent only 2.5 per cent.

In 1935, when income was up to 68 per cent of 1929 levels, they spent 4.7 per cent. These figures, according to Mr. Davis, show that farm income must exceed a certain minimum below which sales efforts are unavailing before farmers will purchase operating and production equipment liberally.

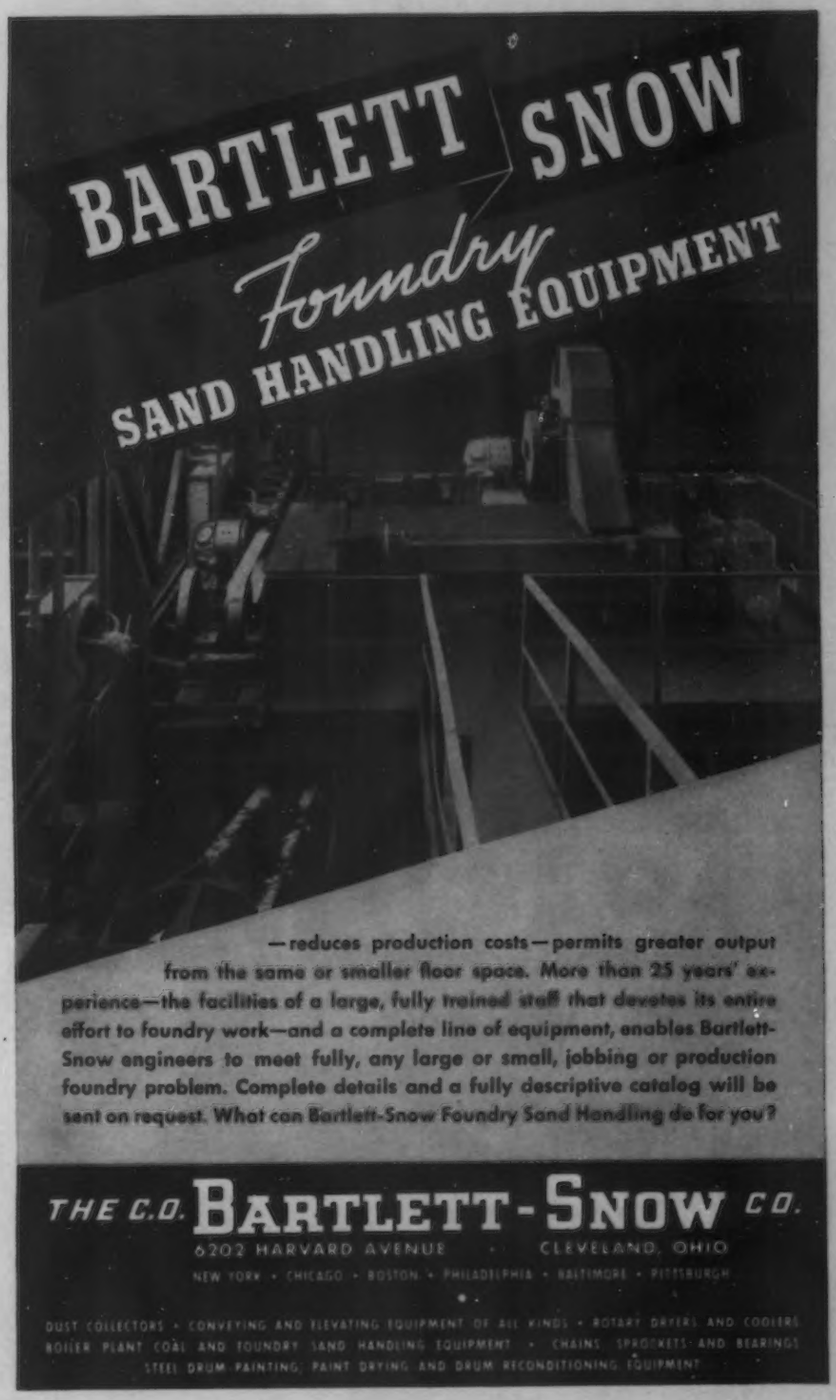
Mr. Davis quoted figures explaining how the present trend of rising prices of commodities farmers buy may offset the benefits of an increase in nominal income. He warned his audience to remember that higher wage rates, higher prices of raw and finished materials, and higher taxes will have a tendency to raise the index number of prices paid and reduce real income, possibly to a danger point unless there are comparable increases in the nominal income of agriculture.

Debt and interest burdens of agriculture and taxes were considerably lower in 1935 than in 1930, according to Mr. Davis, and figures reveal that more of the farmers' money goes for machinery when interest and taxes are low than when they are high.

Another chart prepared by Mr. Davis indicated that introduction of the tractor has helped revolutionize business, in the opinion of Mr. Davis, the 246,083 tractors on farms in 1920 having increased on April 1, 1937, to 1,382,872.

"Introduction of small machines on farms of less than 100 acres is a significant trend," the speaker said. There are about two million such farms, constituting virtually an untouched market.

Earlier, in a joint session of manufacturers and dealers, mutual cooperation and help was urged in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an address by H. A. Schantz, president, National Federation of Implement Dealers' Associations. Mr. Schantz mentioned many dealers' complaints against the manufacturer and advocated changes in the manufacturers' attitude.

About 25 per cent of all farm products are sold cooperatively, according to Clifford V. Gregory, associate publisher, *Wallace's Farmer and Iowa Homestead* and Wisconsin *Agriculturist*. This trend, however, has extended to buying of farm machinery only because by such action the farmer reduces his costs. The resultant competition to dealers, Mr. Gregory feels is not too serious, because since the farmer so buys only to save money, the problem is one of comparative efficiency, which can be overcome if dealers study the situation in their respective territories.

Dr. Glenn Frank, editor, *Rural Progress*, and former president University of Wisconsin, attacked the prevalent theory of economic scarcity and stated that more machinery and more production is needed. He attached great importance to makers of farm equipment because by their close contact with their customers they are in a position to resell the machine to the people as a builder of economic wellbeing.

Highly significant were comments of C. B. Fritsche, managing director, Farm Chemurgic Council, on the farm purchasing power increase that may be brought about by chemurgic developments. Mr. Fritsche showed how eventually, by applying chemistry to many of the products of the farm, additional markets will be created and income correspondingly increased.

In the final address of the meeting, S. G. McAllister, president International Harvester Co., spoke on the "Intangibles in the Implement Industry."

Mr. McAllister pointed out the effect of the intangibles in agriculture on the implement industry, since the farmer is the sole customer, and stated that, "Every misfortune encountered by the farmer as to his production or his prices is also our misfortune."

The industry's own intangibles were traced by Mr. McAllister through the engineering phases of the business and the manufacturing processes themselves, when as is the case today, "Most implement factories are busy night and day, warehouses are empty, dealers' stocks are depleted, and the market remains strong and active." Yet, he pointed out, not so long ago business conditions were just the opposite, with overflowing warehouses and overstocked stores, when the industry's obligations to agriculture "came perilously near swamping our enterprises."

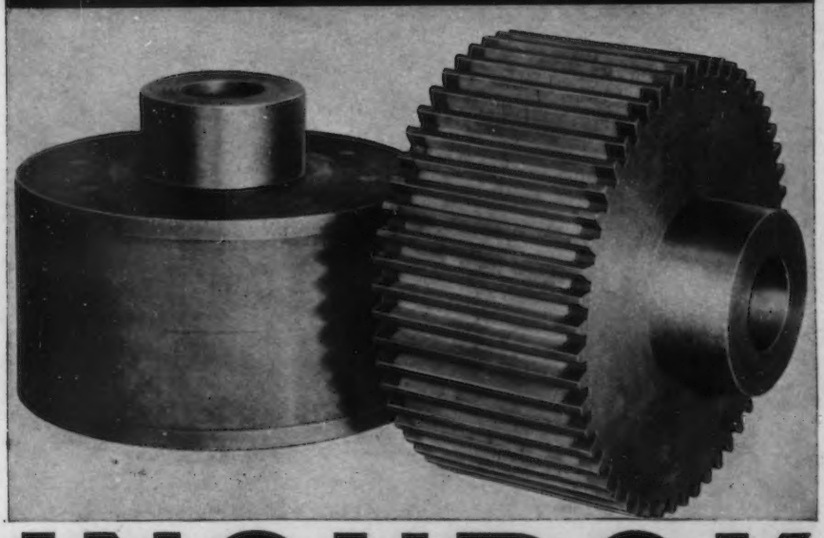
New Competition

"Among the sales intangibles which we face today," Mr. McAllister went on, "is a new kind of competition — a competition from firms and companies and organizations to which farm implements are only an incidental. Some of these competitors may grant credits to their implement customers and some of them may carry repair parts for current models of the machines they sell, but I haven't heard that any of them is equipped to furnish the prompt and expert field and shop service which is part of our industry's obligation and a heavy part of its distribution expense."

Officers Elected

Newly elected officers of the institute are: president, H. C. Merritt, Allis-Chalmers Mfg. Co.; executive chairman, Charles T. Ray,

Save on Power Transmission Costs



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INSUROK gears are *silent* in operation; impervious to attacks by most acids, oils, solvents, reagents and other liquids; withstand abuse and neglect.

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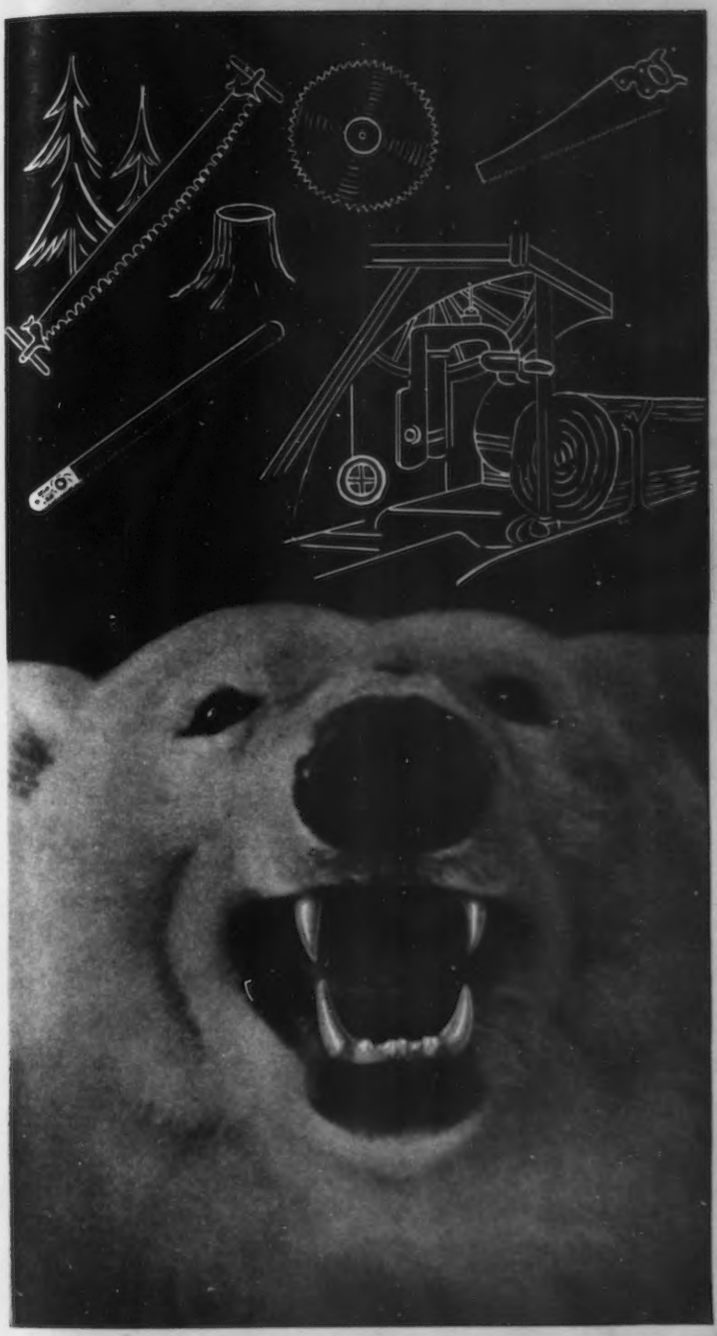

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Members of executive committee are: W. L. Clark, J. I. Case Co., Racine, Wis.; H. L. Dempster, Dempster Mill Mfg. Co., Beatrice, Neb.; B. C. Heacock, Caterpillar Tractor Co., Peoria, Ill.; George L. Gillette, Minneapolis-Moline Power Implement Co., Minneapolis; Cal Sivright, Oliver Farm Equipment Co., Chicago; George S. Hooper, Southern Plow Manufacturers Association, Memphis, Tenn.; and H. C. Angster, National Association of Domestic and Farm Pumping Equipment, Chicago.

Machine Parts Salvaged By Decarbonization

FOR salvaging machine parts a unique application of heat treatment in reverse in a scale free hardening furnace, using a special protective atmosphere, is being made in the service shop of the General Electric Co. in Cleveland.

A manufacturer of bearings found, after machining and heat treating a quantity of small ball bearing races, that the threaded hole in the center was too small. An attempt was made to tap the holes but the pieces had been carbonized and cyanide hardened with a case depth of 0.010 to 0.015 in. and were file hard, the extreme hardness causing the taps to break. The races were several thousand in number, weighing nearly 1000 lb. and they were about to be sent to the scrap yard, which would have meant considerable loss, resulting particularly from the time spent in machining.

These races were reclaimed by being decarbonized in the General Electric shop by putting them through a conveyor type hardening furnace in an atmosphere high in hydrogen and having considerable moisture content. A furnace temperature of 1600 to 2000 deg. was maintained and the parts were kept 20 min. in the heating zone and 40 min. in the cooling zone, being allowed to cool slowly in the latter which also has controlled atmosphere. The parts, on leaving the furnace, were decarbonized, annealed and had clean surfaces.

The races then were sent back to the owner who retapped them, after which they were subjected to the original heat treating operations, being recarbonized, cyanided and hardened.

L. F. Coffin Elected President Of Iron and Steel Engineers

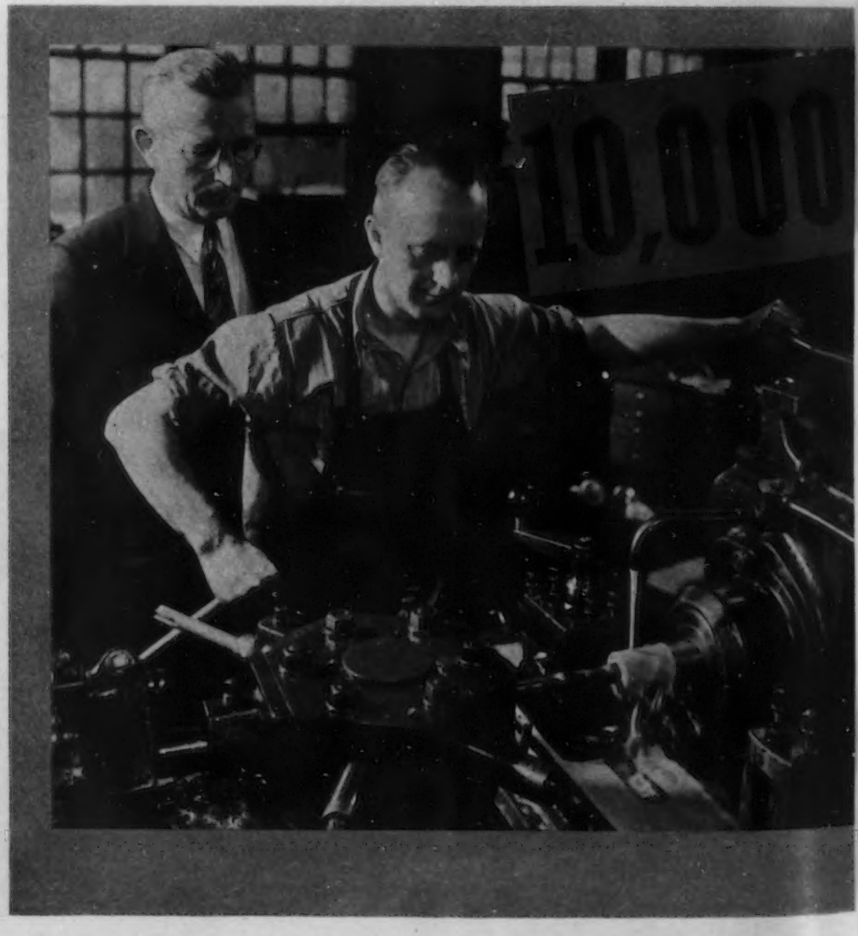
AT the recent convention of the Association of Iron and Steel Engineers in Chicago the following officers were elected: President, L. F. Coffin, superintendent, mechanical department, Bethlehem Steel Co., Sparrows Point, Md.; first vice-president, C. C. Wales, assistant general manager, Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.; second vice-president, W. A. Perry, superintendent, electrical and power department, Inland Steel Co., Indiana Harbor, Ind.; secretary, J. L. Miller, assistant combustion engineer, Republic Steel Corp., Cleveland; and treasurer, F. E. Flynn, general manager, Warren district, Republic Steel Corp., Warren, Ohio.

Recent developments in the rolling of flat steel products were discussed by Stephen Badlam, Pittsburgh consulting engineer, who pointed out that today more men are employed in flat rolled production than ever before. In a brief survey of the wide continuous mills being constructed and under contemplation, Mr. Badlam mentioned the work now in progress on Republic's 98-in. mill in Cleveland, Bethlehem's 56-in. mill at Sparrows Point, and the Tennessee Coal, Iron & Railroad Co.'s 48-in. mill being built at Fairfield, Ala. Otis Steel Co. is adding a four-high stand to its hot mill in Cleveland and the Ford Motor Co. is building another finishing stand for its 56-in. mill at Dearborn, Mich., which is being widened from 48 to 60 in.

Follansbee Brothers Co. is considering the installation of a 43-in. mill, Mr. Badlam continued, while Wheeling Steel Corp. is thinking about a 44-in unit.

Now under construction are six five-stand cold tin mills, two at Tennessee Coal, Iron & Railroad Co., two more at Bethlehem plants, and one each by Wheeling and Carnegie-Illinois.

Carnegie-Illinois is also installing a universal slabbing mill to



handle slabs up to 60-in. wide and 45,000 lb. Great Lakes is building a 44-in. slabbing mill which will supply slabs for its 96-in. mill. Inland is working on a new 46-in. blooming mill, and Republic, a 44-in. blooming mill.

Stainless Steel Uses Gain in Restaurants

THAT stainless steel is becoming increasingly popular in the restaurant field was indicated at the annual exposition of the National Restaurant Association, Oct. 4-8 in Chicago.

Republic Steel Corp., Cleveland, showed a widely diversified group of products made from Enduro stainless steel, including the following: Storefront sections, ice chipping machine, steam jacketed kettle, utility cooking and serving dishes, thermotainer, coffee maker, beverage spoons, cocktail cups, lime squeezer, malted milk shaker, jigger, water pitcher, coffee pitcher, bain-maries, cake pans, meat pans, serving trays, beverage trays, cutlery, ladles, pots, kettles, portable bar, steak tenderizer, tubing, etchings.

Switch to Stainless Steel Seen For Aircraft By Car Builder

A SWITCH from the lighter alloys to stainless steel in aviation is foreseen by Col. E. J. W. Ragsdale, chief engineer, railway division, Edward G. Budd Mfg. Co., Philadelphia. He predicts the development of new engineering methods that will make practical the use of high tensile steels in larger quantities in aircraft. Colonel Ragsdale spoke at the National Aircraft Production meeting of the Society of Automotive Engineers at Los Angles in its sessions from Oct. 7 to 9.

Fortunately for aviation, he declared, the industry will have available a ready-made technique already tested in railroad cars of welded stainless steel. Fabrication of thin steel light-weight structures by means of welding defines the way for the aircraft industry to follow the trend to the use of stainless steel, he said. His paper, "Engineering for Production in Stainless Steel" discussed numerous examples of the design of members for greatest efficiency and greatest ease of fabrication. His paper, as well as a number of others, will be abstracted at some length in succeeding issues. In chart form Colonel Ragsdale showed the relative reduction which has actually been effected in the man-hours required to fabricate a pound of stainless steel as used in railroad cars. During the construction of 60 cars, few of which were alike, the number of man-hours was reduced by 80 per cent through cooperation between design and production departments.

Proponents of sand casting for use in aircraft structures heard two important papers on the subject. "Quality Control of Aluminum Alloy Aircraft Castings" was discussed jointly by Kent R. Van Horn of the Aluminum Co. of America research laboratories at Cleveland and Howard J. Heath of the Aluminum company's castings division, technical department, Los Angeles. A similar discussion on "The Manufacture, Characteristics and Uses of Magnesium Castings" was offered by W. G. Harvey of the American Magnesium Corp., Cleveland.

Radiographic Inspection Methods

In discussing aluminum alloy castings, the authors considered the common structural variations in castings and illustrated with photographs, diagrams and radiographs the means of detecting a large number of possible defects. Both indirect and direct methods of quality control were suggested. Proof-load tests, one of the procedures outlined, was suggested for application only in the case of well-determined and simple types of loading because of the limitations experienced in using this method on complicated aircraft castings. The general technique of radiographic examination and valuable information on sensitivity of the method were covered in the aluminum alloy paper with a special section devoted to the interpretation or radiographs. In particular a thorough study of surface irregularities and comparison of these with a radiograph was declared imperative if internal discontinuities are to be interpreted correctly.

Static breakdown tests were suggested as a means of gaining valuable information regarding design and foundry technique. Van Horn and Heath declared that their

Executives

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The thousands of business firms who cut costs in the past year with new Warner & Swasey turret lathes and tools would read like a Blue Book of American Industry. The men who decided on these purchases probably totaled 10,000 of the keenest, most analytical and far-sighted executives in the country. They are men who invest only when it can be *proven* to them that the investment will result in lower costs, higher profits. That is exactly the kind of proof that can be demonstrated about the new, faster, more accurate, easier-to-operate Warner & Swasey Turret Lathes. May we demonstrate what these improved machines would do in your shop—and for your net profit?

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study "leads to the inevitable conclusion that there is not yet available a satisfactory direct method of predicting the normal service life of a casting." Much of their data is the result of work done in two radiographic units installed in the foundry division of the Aluminum Co. of America, the first in Cleveland in 1927, the second at Fairfield, Conn. A third radiographic unit, they said, is about to be placed in service at Los Angeles.

The development of magnesium casting technique since the first commercial manufacture was begun in 1925, when a 10,000-lb. output was produced, was traced by Mr. Harvey. The industry, he said, reached an output of 55,861 lb. in 1928 and has progressed since to the output of 791,859 lb. in 1936. Important differences in magnesium sand foundry technique procedure compared with that used for aluminum and other non-ferrous metals were outlined.

This paper also treated the subject of inspection and quality control and covered in summary manufacturing methods, alloys, mechanical properties, casting patterns, design considerations, machining procedure and the stability of magnesium alloys in contact with alkalies, fluorides, chromic and hydro-fluoric acid, mineral and organic acids, salt solutions and chloride solutions. Primers and paints for protection of the castings were suggested.

Among the uses outlined for magnesium alloy sand castings approximately 70 per cent were for aircraft. Outside the aircraft field examples given were portable parts of pneumatic and electrical grinding and drilling tools, parts of machines, motion picture equipment, foundry flasks, large plates and core boxes, and jigs and fixtures in machining operations.

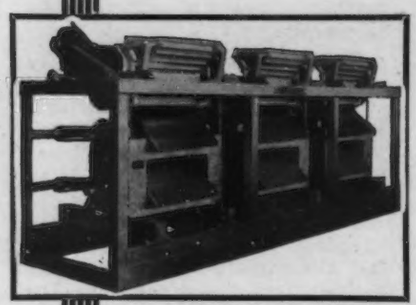
Magnesium castings are more expensive to manufacture than castings of other metals, Mr. Harvey said, and their use must be justified by their weight saving and machining characteristics.

Another paper on aircraft materials covered the subject of plastics and was presented by G. P. Young, of the Rohm & Haas Co., Philadelphia. The author predicted that since aeronautical engineers now know considerable about the stresses in propeller blades and have a better understanding in regard to their speeds, design and vibration, it may be possible that a satisfactory plastic propeller can be manufactured, although earlier attempts to use a thermosetting resin to impregnate fabric laminations were unsuccessful.

Cylinder Honing Cut to Minimum

Maintenance of army and navy airplanes was discussed in two papers, one presented by Major Joseph T. Morris, chief engineering officer at the Rockwell Air Depot, Coronado, Cal., and the other by F. G. Arnold, aeronautical engineer stationed at the San Diego Air Station. Major Morris declared that with the introduction of higher powered engines, cylinder wear has become of great importance. He urged improved design and the increased use of better alloys as the solution to the wear problem. In regard to honing and lapping of cylinders, on which so much stress was being placed a short time ago, he said that these operations are now cut to the bare minimum in the belief that ring clearances and gaps are the important factors in controlling oil consumption.

Arnold's paper dealt principally with the effect of design and construction on maintenance and overhauling problems. The subject of



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metal corrosion, he said, was the most important problem in naval aircraft. "Of special import is the susceptibility of aluminum alloys to electrolytic action in the presence of salt water and a dissimilar metal," Arnold said. He urged the necessity of insulating steel fittings from aluminum alloy members. Corrosion-resistant steel, although passive to corrosion itself, has a violent reaction on the aluminum alloy in the presence of salt water.

The procurement plan policy of the Army Air Corps was outlined to the members of the Society by Major Joseph L. Stromme, from the office of the Assistant Secretary of War. He declared that already more than 20,000 manufacturing establishments have been enlisted in the Air Corps program.

Acetylene Association Plans Large Meeting

THREE technical sessions, with 15 or more papers; two comprehensive round table group meetings; two luncheon sessions, one to include the annual business meeting; and an extensive inspection trip to the Ensley and Fairfield plants of the Tennessee Coal, Iron & Railroad Co., have been planned for the 38th annual convention of the International Acetylene Association, to be held at the Tutwiler Hotel, Birmingham, Nov. 10-12.

A luncheon under the chairmanship of C. D'W. Gibson, vice-president, Air Reduction Co., and president of the association, will open the convention. Speakers will include J. L. Perry, president Tennesee Coal, Iron & Railroad Co., and Dr. James Shelby Thomas, president Chrysler Institute of Technology, Detroit, who will deliver the keynote address on "New Frontiers for Smart People."

The first technical session will include the following papers:

Butt-Welding of Railroad Rails, by R. R. Cummins, assistant general manager Central of Georgia Railway; Piping Design, Fabrication and Erection, by O. B. McLaughlin, master mechanic Freeport Sulphur Co.; Joining Copper Bus-Bars With Blazing Alloys, by R. A. Goeller, vice-president Hatzel & Buehler; Bronze Welding of Cast Iron Pipe, by Dr. J. T. MacKenzie, metallurgist American Cast Iron Pipe Co.; and Multi-Lengthening Cast Iron Pipe by Welding, by C. L. Lane, manager, Attalla works, Walforth Co.

Papers planned for the second technical session, on the afternoon of Nov. 11, are:

Oxy-Acetylene Cutting in Fabrication, by A. E. Gibson, president Wellman Engineering Co.; Management of Machine Cutting Operations, by R. F. Helmkamp, engineer, Air Reduction Sales Co.; Cutting and Tempering Structural Steels, by H. H. Moss, development engineer Linde Air Products Co.; Use of Shape-Cut Parts in Machine Design, by a representative of the Lukens Steel Co.; and Oxy-Acetylene Cutting As Applied to Repair and Conversion of Cargo Vessels to Tankers, by A. C. Leigh, engineer Ingalls Iron Works Co.

Maintenance and operation uses of the oxy-acetylene process will be covered in the final technical session, Nov. 12. Papers will include:

Selective Hardening of Ferrous Materials with the Oxy-Acetylene Flame, by R. L. Rolf, metallurgist, Lakeside Steel Improvement Co., Cleveland; Flame Hardening, by J. T. Howat, superintendent heat treating, American Spiral Spring & Mfg. Co., Pittsburgh; Uses of the Oxy-Acetylene Process in Steel Mill Operations, by W. J. Sannemann, metallurgist, Tennessee Coal, Iron & Railroad Co.; and

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COLD DRAWN FLATS
WIDELY SPECIFIED FOR ALL
TYPES OF MACHINE MOUNTINGS
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Wyckoff extra Wide Flats up to 12"x2" are now being made on a production basis permitting unusual economies to the machine tool builder. They are ideal for heavy bed plates, mountings, backing plates or any other application where flat, smooth-finished surfaces, accurate dimensions and true, right-angled edges are not only desirable but essential. Ask us to quote you on your requirements.
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Welding Stainless and Alloy Steels, by H. C. Whittmer, Republic Steel Corp., Cleveland.

Of the two round table discussions, one, on the evening of Nov. 10, will comprise a group of simultaneous meetings for discussion of problems of economics, management and design as related to welding and cutting. Topics to be covered by the separate groups include: Codes and operator training; stainless and alloy steels; nonferrous metals; hard facing; pipe welding; cutting and the use of the oxygen lance; and fire prevention and safety. The second round table session, on the evening of Nov. 11, will be devoted to practical operating problems in hard facing, bronze welding, low temperature brazing and use of the air-ecetylene flame, sheet metal and steel plate welding, and other applications.

H. F. Reinhard, 205 East Forty-second Street, New York, is secretary of the association.

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Cold Metal is prepared for special demands as well as standard requirements. Unusual sizes of Cold Rolled Precision Strip Steel such as 24" x .005" or 19" x .002" in extra large coils are regularly produced, illustrating the wide range of our operations.

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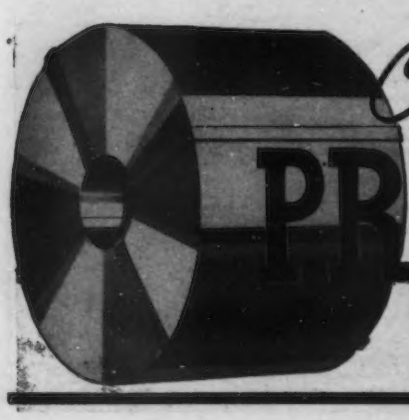

Cold Rolled PRECISION STRIP STEEL

Domestic Chromite Now Being Mined

PRODUCTION of chromite in sufficient quantities to make this country independent of foreign sources is a possibility resulting from the successful use of trucks in working hitherto inaccessible deposits in southern Oregon and northern California.

The presence of chromite in this area has long been known but actual mining operations had to wait the advent of trucks capable of traversing rough, mountain trails with large loads. That problem now has been solved.

Ore, taken out of a mine near O'Brien, in the northern part of California, is hauled 66 miles in a Ford truck to the nearest railroad. Twenty-six miles of this distance is over mountain trails so narrow and tortuous that the rear end of the truck must be skidded around some curves.

The truck makes two round trips a day. Equipped with four wheel drive, it carries 10 tons of ore each trip. This is about four tons over the minimum establishd to make the operation profitable.

The ore is unloaded at Wilderville, Ore., and from there is shipped over the California & Oregon Coast Line to the Rustless Iron & Steel Corp. in Baltimore.

C. E. Tuttle, president of Rustless, states that there is promise of a domestic supply sufficient to fill his company's needs and at a cost considerably lower than that of imported chromium.

Continuous Mill Starts In Germany

THE first continuous sheet mill erected abroad has just been placed in operation in Germany and the second will be completed shortly in England.

Both mills, designed to meet the growing demand abroad for better quality and more uniform sheets in the automobile specialty industries, are licensed to use American Rolling Mill Co. patents. The German mill, a 55-in. hot unit, capable of rolling a half million tons of sheets a year, is at Dinslaken, placed into production by Vereingte Stahlwerke, A.G.

The British mill, part of a $50,000,000 project, is being built at Ebbw Vale, Wales, by Richard Thomas Co., Ltd., Great Britain's largest tin plate producer. It consists of a 54-in. hot mill and two cold reduction mills with an annual capacity of 500,000 tons.

Republic Announces Heat Treated Casing

REPUBLIC STEEL CORP., Cleveland, has announced the development of a new heat treated oil well casing, which, it is stated, can be set to greater depths without increasing weight or changing the factors of safety. A heat treating process that has not hitherto been adapted to ferrous products on a large commercial basis is used. To accomplish large scale production, a special furnace was designed and installed in the Republic tube mill at Youngstown.

The heat treatment of the new alloy steel casing was developed by the Republic technical staff after several years' research work. The company points out that the process is not to be confused with ordinary heat treatment, designed merely to relieve strains. The changes that the steel undergoes in the process are partly the result of a controlled balance between the chemical elements of the material; in addition, the controlled degree and duration of the heat treatment bring about a phenomenon known as precipitation hardening. High ductility to resist shock and high compressive yield point to resist collapse are results that are claimed for the process.

With the use of Republic's cold forming and electric resistance welding and the heat treatment of the casing, it is said that all of the factors necessary for greater setting depths without increase in weight or change in safety factors are arrived at in the new product.

Tests have been certified by the Pittsburgh Testing Laboratory and are published by Republic Steel Corp.

Chicago Power Show Draws Many Exhibits

PURCHASING agents, technicians and research engineers and other industrial executives last week viewed the more than 150 exhibits on display at the Chicago Exposition of Power and Mechanical Engineering at the International Amphitheatre in Chicago.

A large display was provided by the Crane Co., which featured shop-fabricated welded piping and pressure vessels, and many samples of its valve products. The Edward Valve & Mfg. Co., East Chicago, Ind., showed a 2½-in. 1500-lb. blow-off valve.

Jones & Laughlin Steel Corp. and Youngstown Sheet & Tube Co. represented the major steel producers, the former exhibiting seamless pipe for boiler tubes, and J. & L. junior beams for steel and concrete floors in residences. High pressure steam joints, made of extra heavy seamless were also shown. Youngstown featured a scale model of the new three stand, four-high, 72-in. cold reduction mill at Campbell works, and a stamping machine which formed souvenir ashtrays from small coils of strip rolled especially for the occasion.

The Link-Belt Co. showed a complete line of babbitted and anti-friction bearings and take-ups, motorized gear and speed reducers, silent chain drives and belt conveyor idlers. An actual installation of its overhead materials handling equipment was featured by the American Monorail Co., Cleveland.

Yale & Towne Mfg. Co., Philadelphia, had several of its hand trucks and jacks on the floor, as well as a large lift truck, and a display of spur-geared blocks. The

It is a simple matter to bring them down with Towmotor tractors and lift trucks. Towmotor tractors are straight gas powered for greater economy and 24 hour uninterrupted service. Full spring suspension on all four wheels. Short turning radius. High speed both forward and reverse for pushing or pulling with equal ease, on full floating axle.

Towmotor lift trucks are also built with high speed both forward and reverse. Dual tired driving wheels under the load. Designed for sharp angle turns and quick maneuvering in close quarters. Hydraulic lift and tilt. Low or high mast with scoop, fork, ram, flat plate or crane hook adaptors. Capacity up to 6000 lbs. on standard models. Maximum gas consumption of Towmotors ½ gallon per hour. Write for new bulletins and specifications today.

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Chicago Belting Co. in a large exhibit featuring its belt products also showed a Rockwood pivoted motor drive.

Display Metal Hose

The Chicago Metal Hose Corp., in a tubing display, emphasized a new type metal hose known as "Avio-flex", which is designed for severe and continuous flexing and is impervious to gasoline, hot oil, etc. Westinghouse Electric & Mfg. Co. featured splashproof motors and other types of electrical equipment, while industrial lighting apparatus was exhibited by General Electric Vapor Lamp Co. The Oilgear Co., Milwaukee, makers of fluid power pumps, motors and transmissions, displayed engines equipped with precision speed control, variable speed drives, remote control, and adjustable hydraulic braking.

Graham Transmissions, Milwaukee, showed among other things, its variable speed transmission, while Cutler-Hammer, Inc., Milwaukee, attracted comment by its exhibit of motor controls. Diesel power, and electrical and power transmission equipment, was shown by Caterpillar Tractor Co. Timken Roller Bearing Co. emphasized the use of bearings for mine equipment and had a working display of fuel injection equipment.

Contour sawing was displayed by Continental Machine Specialties, Inc., Minneapolis. The Brett Machinery Co., Chicago, had a practical exhibit featuring a new Grob die-making machine, a Moore jig borer, a power screwdriver with samples of work produced, and a multiplex wire forming machine, that can also be used as a punch press in simple forming operations involving not more than ½-in. strip.

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Sheared and Universal Plates
Forging Billets, Slabs
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ROLLED STEEL
FLOOR PLATES
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The established policy of this Company is to have its officials give their careful attention to all manufacturing processes. In this way close control is maintained, and customers are assured that every requirement is properly met.
Repeat orders have shown the value of this policy to customers as well as to the Company.
CENTRAL IRON & STEEL CO.
HARRISBURG PENNSYLVANIA

British Need of Scrap Stressed

LONDON (*Special Correspondence*).—Joseph Ward, chairman of Thomas W. Ward, Ltd., one of the biggest firms in the British scrap metal industry, made a notable statement on the growing importance of scrap supplies to British steel works in the course of his address at the concern's recent annual meeting.

"For many years I have repeatedly emphasized the vital importance of scrap iron and steel products as the chief raw materials for British steelworks, and the value to them of the scrap industry of the country," said Mr. Ward. "This has been confirmed by the subsequent scarcity of such materials only remediable by imported scrap at very high prices. The scarcity of scrap that has arisen is explained by the fact that the production of steel in this country during the period under review was 12,293,200 tons, an increase of 1,508,600 tons over the previous 12 months. Exports of scrap during the year occurring principally before control was established were 240,228 tons, as against 130,509 tons, 109,719 tons more than in the previous year, and the imports, which last year I gave you as 975,573 tons, were 681,703 tons, 293,870 tons less.

Sixteen hundred persons recently attended a celebration at the Pangborn Corp.'s plant, Hagerstown, Md., when families of employees were welcomed by officials, Thomas W. and John C. Pangborn, in a plant inspection. The Pangborn company is one of the largest manufacturers of blast clean and dust control equipment.

...OBITUARY...

R. R. JARDINE, Pittsburgh district sales manager, National Tube Co., died Oct. 6 at Pittsburgh. Well known in the steel business throughout the Central West, Mr. Jardine spent his entire business career with National Tube here and in Kewanee, Ill. He was a graduate of the University of Illinois.

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CHARLES E. HILDRETH, retired industrial leader and for many years manufacturer of machine

R. R. JARDINE

tools and special machinery, died at his home in Worcester, Mass., on Oct. 6, aged 70 years. After he was graduated from Amherst College in 1892, Mr. Hildreth shortly went into the machinery manufacturing business. For years he was prominently identified with the New England Foundrymen's Association, and also counsellor for the National Metal Trades Association.

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HARRY R. MCMAHON, retired president of the Standard Steel Spring Co., Pittsburgh, died Oct. 3 at his home in Coraopolis Heights, Pa. His first executive position was as secretary of the Cleveland, Lorain & Wheeling Railroad, now a part of the Baltimore & Ohio system. He later joined the Pittsburgh Coal Co., of which he became assistant secretary. Mr. McMahon organized the Standard Steel Spring Co. in 1914 and was its president until last year. He was 64 years old.

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A. F. KNOTTS, a former counsel for the United States Steel Corp., who purchased the land on which the city of Gary, Ind., is located, and who, according to Gary historians, was responsible for the corporation locating there, died in Florida last week, aged 81. Mr. Knotts is also given credit for having induced the directors of the corporation to establish a modern city at Gary, free of the evils and stigma of a company town. As Indiana counsel for the corporation, Mr. Knotts won the directors over to Gary, rather than Waukegan, Ill., as the proper site for the mill, by demonstrating its command of direct water shipments of ore and its minimum mileage access to vital Lake points.

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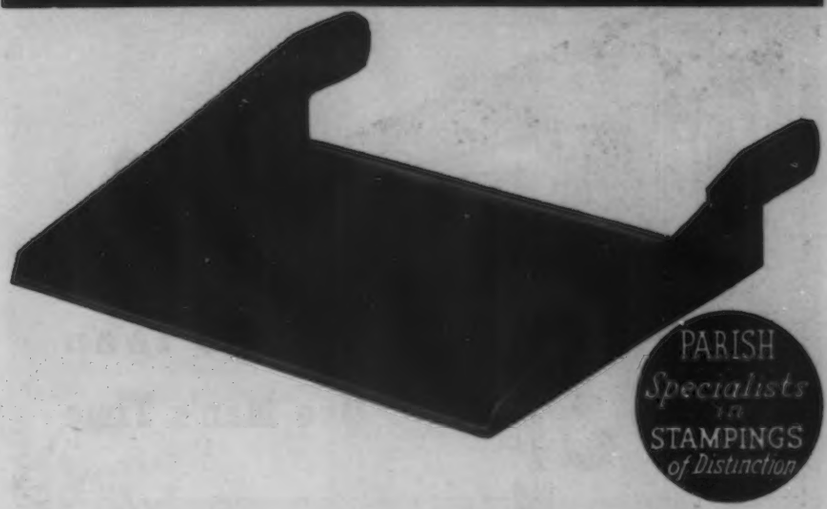
EDWARD D. DONEY, who owned and operated the Althaus &

HE WANTED IMPROVEMENT



THE inclinator step illustrated is of pressed steel 1/8" thick; 15" x 15 1/2" x 3 3/8" high. The welded end lugs provide the necessary strength, at less cost than is feasible by any other method.

This is typical of what Parish engineers are able to accomplish, by a skillful combination of stamping and welding, to provide better parts of improved appearance and lowered final cost.

Whether the stamping be simple or complicated, large or small, complete as it comes from the press or involving building up thru other operations, we welcome the opportunity to discuss the problem with you.

PARISH PRESSED STEEL CO., READING, PA.

Pacific Coast Rep.: F. Somers Peterson Co., 57 California St., San Francisco, Cal.

Wheeler Foundry & Mfg. Co., Waupun, Wis., for 25 years prior to his retirement in 1935, died on Oct. 5, aged 72 years. He was born in Waupun and was a law graduate of the University of Kansas.

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FRED W. PRIEP, president of the Laclede Stoker Co., died in St. Louis of heart disease at the age of 68 years. He was born and educated in St. Charles, Mo., and had been a resident of St. Louis for 38 years. He and his brother, Henry W. Priep, and Henry F. Welsch, in 1904 organized the Tower Grove Foundry, which became the Laclede Stoker Co., several years ago. Mr. Priep had recently completed a four-year term as an alderman of Clayton, a suburb.

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J. STERLING PLACE, vice-president of the Hudson Smelting & Refining Co., Newark, N. J., died on Oct. 9 as the result of injuries suffered when he was struck by an automobile. He was a graduate of the Colorado School of Mines.

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SIR JOHN DEWRANCE, chairman of Babcock & Wilcox from 1899 until his retirement in July, this year, died on Oct. 7, aged 79 years.

U. S. Machinery Exports Climb

UNITED STATES exports of machinery in August rose 78 per cent above the same month last year to $21,692,724, with eight major groups sharing in the advance, according to the Machinery Division of the Department of Commerce. For the first eight months exports were 46 per cent ahead of the entire year of 1936, or $162,675,339.

Mining, well and pumping machinery exports in August were valued at $5,708,431 against $2,477,771 in the like month last year while construction and conveying machinery shipped abroad totaled $2,312,936 compared with $1,024,222 a year earlier.

The Department of Commerce reported foreign sales of power-generating equipment in August at $1,412,965 against August, 1936, shipments of $639,578 while exports of power-driven metal-working machinery totaled $4,190,386 in that month compared with $2,234,789 in August, 1936. Textile, sewing and shoe machinery amounted to $1,832,099 against $1,709,720 last year.

Scrap Institute Gets Award For Work

THE Institute of Scrap Iron and Steel has been advised by Secretary of Commerce Roper that it had been awarded a "certificate of recognition" for outstanding accomplishment in the trade association field, in connection with the annual award made by the American Trade Association Executives, it was announced today by Benjamin Schwartz, director general of the institute.

The jury of award, of which Secretary Roper was chairman, consisted of the following: Bruce Barton, of Batten, Barton, Durstine & Osborn, Inc., New York; Colby M. Chester, of General Foods Corp., New York; Harper Sibley, of Sibley Farms, Rochester, N. Y.; Prof. Roswell C. McRea, School of Business Administration, New York University.

Experience has proved that it does not pay to utilize man power in handling loads of 500 pounds or less . . . The Lo-Hed Quarter-Ton Hoist—the original electric hoist of its capacity—was built specifically for loads too heavy for one or two men to handle safely, profitably . . . The new Lo-Hed catalog shows you its 21 features, tells about the 96 other *standard* Lo-Hed Hoists. Send for a copy.

AMERICAN ENGINEERING COMPANY
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A-E-CO LO-HED Hoist

Other Products: A-E-CO Taylor Stokers, A-E-CO Hele-Shaw Pumps, Motors and Transmissions, A-E-CO Marine and Yacht Auxiliaries

Gentlemen: Please send me your complete new Lo-Hed catalog including an outline of how to easily and properly select a hoist for any requirement.

*Name of Company*_____

*Company Address*_____

*Your Name*_____

*Your Title*_____

Howard Supply Co. to Handle Republic Pipe

HAROLD E. HOWARD, who, as recently announced in THE IRON AGE, has organized the Howard Supply Co., 5125 Santa Fe Avenue, Los Angeles, will serve as distributer of Republic Steel

HAROLD E. HOWARD

Corp.'s oil country pipe in California. Mr. Howard, who is one of the best-known steel men on the Pacific Coast, was for many years general manager of the Ducommun Corp., Los Angeles, one of the largest general steel distributers in the country.

Associated with Mr. Howard in the Howard Supply Co. are L. George Trembley, who is vice-president, and Arthur G. Moyer, secretary and treasurer.

The warehouse taken over by the Howard company is a building formerly occupied by the Union Iron Works prior to its merger with the Consolidated Steel Corp. The buildings are being modernized.

Meeting On Housing Failure Scheduled

A CONFERENCE to analyze causes of the slowing down of residential building will be called for late in November or early December at Washington, George H. Davis, president of the Chamber of Commerce of the United States, announced.

"At the beginning of 1937 it was the general opinion that there would be an increase this year over the 1936 volume of between 50 and 60 per cent," Mr. Davis said. "In the past few months, however, the rate of increase has materially slackened so that it now appears that the increase will scarcely be more than half of that predicted.

"In 1928 private residential building accounted for some 40 per cent of a total $11,000,000,000 volume of private and public construction while in 1936 it accounted for only 18 per cent of a total $6,750,000,000 volume," Mr. Davis said.

Standards Revised On Roofing Ternes

A NEW packing schedule for roofing ternes in boxes and rolls and a method of marking roofing rolls will be effective Nov. 1, according to an announcement by the Division of Simplified Practice, National Bureau of Standards. Copies of "Simplified Practice Recommendation, Roofing Ternes, R30-37," may be obtained from the National Bureau of Standards.

SPIRAL-BEVEL GEARS

by . .

PHILLIE GEAR

Because the teeth of Spiral-Bevel Gears have a continuous pitch line contact, they engage gradually (with an overlapping action)—and there are several teeth always in actual contact with each other. This assures extremely efficient, quiet, long-lived, trouble-free operation, with a large factor of safety. Phillie Gear has the special machines and trained men to make Spiral-Bevel Gears in any quantity, of any material, up to 30" diameter. Write for further details and your copy of the new GEAR BOOK.

PHILADELPHIA Gears

Philadelphia Gear Works
Industrial Gears and Speed Reducers
Erie Avenue and "G" Street
PHILADELPHIA

Bethlehem's $75,000,000 Expansion Program Nearing Completion

EXPANSION of the Bethlehem Steel Co.'s Maryland plant at Sparrows Point, Md., which has been under way for some time, will soon be completed. The plant will then have a total ingot producing capacity of 2,517,000 gross tons annually. Important new construction includes two units for the cold reduction of tin plate, with an annual capacity of 270,000 tons, a new continuous 54-in. hot strip mill of 780,000 tons annual capacity and a high-speed rod and bar mill of 240,000 tons annual capacity. The total cost of all of the improvements, including those already completed, will be $75,000,000. The illustration shows the new hot mill department, which will be ready for operation in November. The mill building proper is at the left, flanked by the furnace section at the right. The steam plant that serves the hot mill is shown at the extreme right in the foreground. The foundation and the partially completed first floor of the division's office building appears in the central foreground.

CULLMAN SPROCKETS

Over 45,000 Sprockets in Stock.

Special Sprockets made to meet your requirements.

Send for our new No. 19 Catalog.

CULLMAN WHEEL CO.

1343 ALTGELD STREET **CHICAGO, ILLINOIS**

Rhodesia's First Diesel Rail Car Has Welded Steel Body

THERE has recently been introduced on the railway lines of Rhodesia in South Africa the first diesel powered rail car in that country. Welded steel construction is used in the car body, which has a seating capacity of 56 passengers and a baggage compartment for two and a half tons of mail and baggage. With the 240 hp. six-cylinder engine the car's maximum speed is 45 miles an hour.

Do you need SPACE in your Stockrooms or Tool Cribs?

This shows how ROTABINS can be installed in your own shelving.

Are they crowded?

Do they need expanding?

Do they need relocation?

Are you planning new ones?

Do you want to save Time and Space?

IF SO

Rotabin sectional rotating steel shelving will help to solve these problems.

Rotabins save 40-60% of floor space.

They increase present floor space capacity and can be used with present shelving.

Write us for information. No obligation.

Rotabin Equipment Protected by U. S. Patents

THE FRICK-GALLAGHER MFG. CO.
WELLSTON OHIO

Pioneers in the development, design, manufacture and installation of sectional rotating bins.

Rail Electrification Ahead of Schedule

THE Pennsylvania Railroad's Eastern electrification program will be completed several months earlier than the midsummer of 1938, originally expected, with preliminary tests using electric locomotives from the present terminus of the electrified area at Paoli, Pa., 20 miles west of Harrisburg, to begin shortly.

With the road's main line to Harrisburg, the Pennsylvania's current program includes the heavy freight route between South Amboy and Monmouth Jct., N. J., the low grade freight line at Harrisburg, the freight lines along the Susquehanna River between Harrisburg and Perrysville, Md., and the freight route between Columbia and Harrisburg, via Royalton, Pa.

On the 315 mi. electrification program, now 65 per cent complete, are 9150 men, including 2450 railroad technicians and skilled employees, with the force likely to reach 10,000 shortly.

CLARK BOLTS

FOR ANY JOB

Eighty-three years of performance, service, dependability, and experience back of every CLARK Bolt, Nut, Screw and Rivet.

Standards and Special.

Write for latest catalog.

Let us quote.

CLARK BROS BOLT CO.
MILLDALE, CONN.

Japan Needs High-Grade Machine Tools

A CONSERVATIVE estimate puts the total machine tool demand of Japanese aircraft and automobile companies at 20,000,000 yen, of which only a part can be filled by domestic makers, according to a report released by the Okuyama News Service on July 27 and abstracted by the U. S. Department of Commerce in "World Machinery News" for September. During the first half of 1937, imports of machine tools from foreign countries exceeded 20,000,000 yen. Machine tool production in Japan in 1935 was valued at 21,000,000 yen; output in 1936 is expected to be 30 per cent higher and in 1937 is expected to be valued at 30,000,000 yen. It is impossible to state what proportion of this total value represents high grade products meeting the requirements of aircraft and automotive production, but the inference is that it is small, borne out by recent purchases in this country.

In spite of the demand, however, imports of additional machine tools from abroad are not expected to be made without trouble as a result of exchange control and the reluctant attitude of exporting nations, heightened by recent diplomatic developments.

Present aircraft concerns in the market for millions of yen of machine tools include the Showa Airplane Co., the Japan Aircraft Co., the Nagoya plant of the Mitsugishi Heavy Industries, and the Tokyo Gas & Electric Engineering Co. In the automotive field, Mitsubishi's Tamagawa factory, the Kawasaki plant of the Ikegai Iron Works and the Tokyo Jidosha Industry Co. need 2 to 3,000,000 yen of machine tools, not to mention the demands of the Nissan and Toyata automobile companies.

There are five leading tool making companies in Japan, and in addition a number of engineering shops are devoting more of their production to machine tools.

Quick-Drying Primer For Metal Products

A SYNTHETIC primer for use on metal products that air dries in 5 min. and, therefore, reduces the rejects due to shop dust and dirt, has been developed by Maas & Waldstein Co., Newark, N. J.

This new "speed" primer is suitable for use under air-drying lacquer-enamels or baking synthetic

enamels, or as a shop coat. It air dries, or can be force dried or baked, giving a flexible schedule ranging from 2 hr. at 160 deg. F. to 20 min. at 275 deg. F. It is said to have good adhesion, excellent building and holdout properties and is easily sanded.

Ohio Seamless Tube To Use Electric Weld

THE Ohio Seamless Tube Co., Shelby, Ohio, has acquired a license from the Republic Steel Corp. to use the Johnston process of electric welding in the manufacture of tubing. A portion of the company's plant has been equipped with two units for producing tubing from carbon steel strips. These two units are capable of producing from 40 to 70 ft. of electric welded tube a minute. Others will be installed as required.

For the time being, the company says, the output of welded mechanical tubing will be confined to carbon steel in the more popular sizes and weights, but future plans call for a set-up by which Ohio tubing will be produced by the electric weld process in all types and sizes. In addition to straight tubing, the plant is equipped to make odd sizes and shapes as well as bent tubing to any specification.

A. S. M. E. Elects Officers for 1938

THE American Society of Mechanical Engineers has elected the following new officers, who will assume office on Dec. 10, 1937:

President—H. N. Davis, President Stevens Institute of Technology, Hoboken, N. J.

Vice-Presidents—F. O. Hoagland, master mechanic, Pratt & Whitney Division, Niles Bement-Pond Co., Hartford, Conn.; B. M. Brigman, dean, Speed Scientific School, University of Louisville, Louisville, Ky.; Harte Cooke, mechanical engineer, McIntosh & Seymour Corp., 100 Orchard Street, Auburn, N. Y.; W. H. McBryde, consulting engineer, San Francisco; L. W. Wallace, director, Division of Engineering Research, Association of American Railroads, Chicago.

Managers—Carl L. Bausch, vice-president, Bausch & Lomb Optical Co., Rochester, N. Y.; S. B. Earle, dean, School of Engineering, Clemson College, S. C.; F. H. Prouty, partner, Prouty Brothers Engineering Co., Denver, Colo.

Germany Prohibits Steel Expansion Except By Permit

LONDON (*Special Correspondence*).—As a result of the founding of the new State company (the Reichswerke A. G. "Hermann Goering") to manufacture iron and steel from low-grade German ores, Dr. Schacht, Reich Minister for Economic Affairs, has issued an order prohibiting the erection of new iron and steel works, or of the extension of existing works, by private enterprise without previous permission by the Government.

The new order applies to the erection of blast furnaces, coke ovens, works for the manufacture of steel or steel alloys, rolling works, foundries, etc.; to extensions in the capacity of existing works; and to the reopening of works which have been continuously closed for more

BLAST CLEANING

AIRLESS BLAST BARREL

PRESSURE BLAST CABINET

WHICH WILL SERVE YOU BETTER?

Both are good. Both deliver that "extra dividend" every day in the year to satisfied users in all parts of the country. Satisfaction, plus economy and efficiency, has been the Pangborn guarantee for more than thirty-three years.

If you are anxious to obtain a lower cost per ton in cleaning gray iron, malleable or steel castings, heat-treated parts, forgings, stampings, etc., see Pangborn. Get Pangborn facts and figures to *show why* Air or Airless type equipment should be used for your needs. Then, BUY PANGBORN with utmost confidence . . . and Pangborn will back up your choice with unfailing service, and equipment that will clean your work quicker, at lower cost, and without profit-eating interruptions.

SEE BOTH TYPES ON DISPLAY IN OUR BOOTHS AT THE NATIONAL METAL EXPOSITION, ATLANTIC CITY

PANGBORN CORPORATION

The World's Largest Manufacturer of Blast Cleaning and Dust Collecting Equipment

HAGERSTOWN . . . . MARYLAND

WHY G-E BULBS
give more light this year

Today's Edison MAZDA lamps actually give you more light than the same size lamps of a year ago . . . without using any additional current and without costing a penny more. And these new lamps *stay brighter longer* than ever before.

This is because constant improvement and technical development made in MAZDA lamp research laboratories have continually raised the efficiency of MAZDA lamps year after year. Whenever you buy these bulbs you get lamps that offer the advantages of the newest developments.

Next time you order lamps for your office, shop or factory, be sure to take advantage of the extra light these new, brighter G-E bulbs offer. Make sure that every bulb you buy carries the famous GE trade-mark. General Electric Company, Nela Park, Cleveland, Ohio.

USE THE G-E LIGHT METER TO MEASURE YOUR LIGHTING

The General Electric Light Meter tells whether employees are getting enough light for easy seeing, and is helpful in checking from time to time on whether this amount of light is being maintained. Costs only $11.50.

EDISON MAZDA LAMPS

GENERAL ELECTRIC

than six months since March 15 last.

The order is designed to secure the planned development of the German iron and steel industry and guard against the possibility of overlapping or excessive capacity in individual branches of the industry.

Ohio Crankshaft Co. Building New Plant

OHIO CRANKSHAFT CO., Cleveland, has under construction a new plant at East 42nd Street and Harvard Avenue that will provide 75,000 sq. ft. of floor space in a building 500 x 150 ft. The plant is on an 18-acre site providing room for additional units similar to the one under construction. The cost of the land and building totals $300,000 and new equipment to be installed will cost an additional $400,000.

The new plant will include a laboratory for research on the Toco process for surface hardening crankshafts and other machinery parts. The remainder will be used for the manufacture of crankshafts and Toco hardening operations. Heavy equipment will be installed for machining and hardening crankshafts weighing up to 2000 lb., such as those used in large diesel engines for locomotives.

On completion of the new plant, operations in the present factory will be expanded for Toco hardening installations. W. C. Dunn, president of the company, stated that the expansion is necessitated by the growing demand for Toco hardened gasoline diesel engine crankshafts and cam shafts and for hardening equipment to be installed under license in other manufacturers' production lines.

Bethlehem Issues Movie Of Bridge

A NEW talking motion picture called "Building the Golden Gate Bridge," giving a complete story of construction of the bridge across San Francisco's Golden Gate, will be released Oct. 10 by Bethlehem Steel Co.

Assembly and erection of steel going into the structure's 746-ft. towers and other parts are shown in a series of scenes accompanied by a descriptive lecture on a sound track.

Other motion pictures in Bethlehem Steel's library are on such subjects as: The Making of Alloy Steel; Wire; Galvanized Steel Sheets; the Manufacture of Structural Steel Shapes.

Coming Conventions

Oct. 14 to 16—Electrochemical Society, Inc., 72nd general meeting, St. Louis. Dr. C. G. Fink, Columbia University, New York, secretary.

Oct. 18 to 19—Foundry Equipment Manufacturers' Association, Greenbrier Hotel, White Sulphur Springs, W. Va. A. J. Tuscany, Penton Bldg., Cleveland, executive secretary.

Oct. 18 to 19—Steel Founders Society, Hot Springs, Va. R. L. Collier, 920 Midland Bldg., Cleveland, secretary.

Oct. 18 to 22—National Metal Congress, held under the auspices of American Society for Metals, American Welding Society, Iron and Steel and Institute of Metals Divisions, A.I.M.E., Iron and Steel and Machine Shop Practice Divisions, A.S.M.E., Atlantic City Auditorium, Atlantic City, N. J. Information may be secured from W. H. Eisenman, 7016 Euclid Avenue, Cleveland, scretary, A.S.M.

Oct. 19 to 21—Manufacturers' Products Exhibit, Lord Baltimore Hotel, Baltimore. Exhibit is sponsored by Purchasing Agents Association of Baltimore, under the direction of Frank H. Carter, 220 East Pleasant Street, Baltimore.

Oct. 23 to 25—American Iron and Steel Institute, executives of member companies, White Sulphur Springs, W. Va.

Oct. 26 to 29—American Institute of Steel Construction, Greenbrier Hotel, White Sulphur Springs, W. Va. V. G. Iden, 200 Madison Avenue, New York, director.

Oct. 27 to 28—Coal divisions meeting, A.I.M.E., William Penn Hotel, Pittsburgh. A. B. Parsons, 29 West 39th Street, New York, secretary.

Nov. 3 to 5—National Foreign Trade Council, Inc., 24th convention, Cleveland Hotel, Cleveland, Lindsay Crawford, 26 Beaver Street, New York, secretary.

Nov. 10 to 12—International Acetylene Association, 38th annual convention, Hotel Tutwiler, Birmingham, Ala. H. F. Reinhard, 30 East 42nd Street, New York, secretary.

Nov. 17 to 18—Purchasing Agents Association of Chicago, Hotel Sherman, Chicago. Frederick J. Heaslip, Fairbanks, Morse & Co., Chicago, secretary.

A meeting at the plant of the Great Lakes Steel Corp., Ecorse, Mich., is being held today (Oct. 14) by the Detroit chapter of the American Society of Tool Engineers. J. P. Gatherum, the company personnel director, will address the group and members will view movies depicting steel-making operations. An inspection trip through the mills will follow.

INTERNAL TRANSPORTATION

IN the early days of iron and steel, furnaces and mills had to be located in strategic relation to coal, ore and limestone. External transportation dominated.

Today mills are located with reference to markets—and the dominating factor in steel production is *Internal Transportation.*

A few thousand feet of conveyer equipment inside the mill are a more important factor in production, output, costs than hundreds of miles of external travel.

Only the most advanced materials handling equipment embodying the modern principles of Continuous Flow and integrated production is good enough for today's needs. The Steel Industry has adopted Mathews conveyers and systems developed during the last decade of close co-operation with the industry.

Processing Equipment installed during 1936-37, embracing the ultimate in design and engineering in the Steel Industry, is illustrated and described in our catalog on Steel Plant Conveyers. Available now.

The leaders in this industry, responsible for 85% of steel production in the United States and Canada, are applying the Continuous Flow Principle of Handling Materials.

MATHEWS CONVEYER COMPANY 114 TENTH STREET ELLWOOD CITY, PENNA.

MATHEWS

CONTINUOUS FLOW PRINCIPLE OF HANDLING MATERIALS

CONVEYERS

Value of Trade Associations Demonstrated by Malleable Society

THE value of trade associations in maintaining uniform standards by its member producers in an industry, and at the same time assisting in efforts to improve the characteristics of the industry's product, is illustrated by the activities of the Malleable Founders' Society.

The society employs a consulting engineer and a shop practice engineer who devote all their time to visiting the plants of the society's members and advising them on various production problems that arise from time to time. In the course of the engineers' visit, samples of the producer's castings are tested for physical characteristics to determine if the castings are equal to the acceptable minimums.

The success of these activities is reflected in the fact that since 1915 the American Society for Testing Materials has increased its specifications on malleable iron five times. In 1915 the A.S.T.M. specifications called for 38,000 lb. tensile strength and 5 per cent elongation. The present standard carries minimums of 53,000 lb. tensile strength and 18 per cent elongation. A recent test of 5000 sample bars representing the products of 52 malleable foundries, as published by the A.S.T.M., gave the following average physical properties: tensile strength, 54,032 lb.; yield point, 36,603 lb., and elongation, 19.3 per cent. As the result of the society's work, some malleable foundries are prepared to fill orders on the basis of minimum test specifications of 55,000 lb. tensile strength, 35,000 lb. yield point and 18 per cent elongation.

FOR YOU—as for us
In perfecting the famous Houdaille Shock Absorber, and in gradually stepping up daily output from an original dozen units to more than 25,000, Houde's plant engineers have become outstanding specialists in mass production to exacting standards. But the microscopic precision of a Houdaille Shock Absorber's valve parts, which are shown above, is merely a typical example of Houde accomplishment. Much of our activity centers around the production of parts or assemblies for other manufacturers.
If you have problems concerning greater speed, greater precision or greater economy, it is quite possible that they can best be solved by turning some of your production over to us. Our complete facilities are available to you — to bring the same high standards into your manufacturing that are maintained in our own.
HOUDE
ENGINEERING CORPORATION, BUFFALO, N. Y.
A DIVISION OF HOUDAILLE-HERSHEY CORPORATION
SPECIALISTS IN MASS PRODUCTION TO PRECISION STANDARDS

New British Steel Plant To Be Built

LONDON (*Special Correspondence*).—The Commissioner for the Special (Distressed) Areas of England and Wales has announced his decision to acquire a substantial area of land in Jarrow for the purpose of industrial development, known as Palmer's Yard.

The site, which is several acres in extent, is now owned by T. W. Ward & Co., Sheffield, who are dismantling the old plant. The steel works site was chosen for the first Jarrow steelworks plan, which did not mature, and although nothing definite has been announced, it is understood that the site will now be used for the modified steel works plan, estimated to cost £1,000,000 ($5,000,000), and in which the Consett Iron Co. is interested.

New Booklet Issued On USS Cor-Ten Steel

A NEW booklet has been published by the U. S. Steel Corp. covering USS Cor-Ten, a high-tensile, low-alloy steel developed for use where lightness without loss of strength is desired. The 68-page publication describes the application of Cor-Ten to the construction of buses, railroad rolling stock, etc., and photographs are used to illustrate typical applications of this type. Also included is a discussion of the technique of welding, forming and forging this metal.

Plant Enlarged By Westinghouse

WESTINGHOUSE ELEVATOR CO., Westinghouse Electric & Mfg. Co. subsidiary, has moved its headquarters to Jersey City, N. J., where it is establishing one of the largest elevator and electric stairway plants in the country.

Purchase by Westinghouse of the A. B. See Elevator Co., third largest unit in the industry, rounds out the larger company's facilities for making elevators for small industries and apartment houses.

Foremen Training Aids Management

THAT foremanship training not only helps foremen but improves functioning of upper management, was shown at the first fall meeting of the Detroit Society for the Advancement of Management by Robert Lee Howard, head of Wayne University Foremanship Conference Service.

Following Mr. Howard's talk, the personnel men present agreed that such training programs give the management information which it had previously lacked. Better understanding of employee problems and attitudes is another result while proper training of foremen, Mr. Howard said, brings about an elimination of grievances before they assume major proportions.

Unemployment Gains 150,000 In August

UNEMPLOYMENT in the United States in August is estimated by the National Industrial Conference Board at 6,285,000, an increase of 150,000 above July. Total employment in all private enterprises and permanent Government agencies aggregated 46,807,000, a decline of 97,000 from July.

The board reported increases of 73,000 in manufacturing, 6000 in mining, and "a few thousand" in the service industries. This was more than offset by a drop of 118,000 in construction, 31,000 in agriculture, 24,000 in trade, distribution and finance, 9000 in transportation and 2000 in forestry and fishing. The unemployment total in August was 1,430,000 less than in the same month of 1936.

Electromet To Use TVA Power for Plant

ELECTRO METALLURGICAL CO., unit of Union Carbide & Carbon Corp., has contracted to purchase from the Tennessee Valley Authority a large block of industrial power which it proposes to use at a new plant to be located in the Wilson Dam, Ala., area. The contract will run for a period of 20 years, unless a 90-day option to cancel is exercised by the company. The proposed plant will be constructed principally for the manufacture of ferro-alloys, calcium carbide, and other electric-furnace products.

Armco Announces "Zincgrip" Sheets

ARMCO research has perfected a revolutionary type of galvanized sheet with a heavy coating

That Means 70% MORE OIL in Morse Roller Chains — and LONGER LIFE!

70% more oil! Inside the chain, where the wear comes! There's the reason why Morse Roller Chains give longer, more satisfactory service.

The cushion of oil inside every roller means smoother, quieter operation, too. Smooth-running for years, because what little wear there is spreads itself evenly over every link of the chain, eliminating the long and short links that ruin roller chain efficiency.

The new Morse Spring Lock, replacing the old unreliable cotter pins, is another great forward step in roller chain construction. It's easily removed, but it will not shake loose.

It's a truly great chain—yet you can get all its advantages for the cost of the less satisfactory types of drives. Have the Morse representative in your territory give you full information, or write Morse, Ithaca.

The TREND IS TO MORSE Positive DRIVES

MORSE CHAIN COMPANY
ITHACA, N. Y.
Division of Borg-Warner Corporation

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES
MORSE *positive* DRIVES
MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

Your spring troubles vanish (along with our hair) when you seek a DUNBAR solution. That's why we keep adding younger, bushier heads to our organization—so you'll never be without a source of springs and wire parts, when you need them.

DUNBAR BROS. CO.

DIVISION OF ASSOCIATED SPRING CORPORATION BRISTOL CONNECTICUT

CHACE Thermostatic Bimetal is the active element used in Janitrol's safety pilot control, preventing the gas valve on the heater from opening when small pilot flame is not burning.

If your product calls for automatic action at temperature changes, or if your problem is one of controlling temperature, use Chace Thermostatic Bimetal. Made in many types, each to meet specific demands.

W. M. CHACE CO.
1605 Beard Avenue - - - Detroit Mich.

of commercially pure zinc which will not crack or peel when subjected to relatively heavy drawing or forming operations, W. W. Sebald, vice-president of American Rolling Mill Co., has announced.

The new material, produced in both sheets and coils, is known as "Zincgrip" and carries from 50 to 75 per cent more zinc than tight coat sheets generally used in fabricated products. It has been used more than a year in spiral corrugated lockseam drainage pipe and has proved satisfactory, the company announcement says.

G-E's 1937 Orders UP 44 Per Cent

GENERAL ELECTRIC CO.'S orders during the first nine months this year totaled $305,276,556, an increase of 44 per cent above $211,891,038 in the corresponding period of 1936, Gerard Swope, president, has announced.

Third quarter orders received by General Electric amounted to $88,010,937, against $74,922,441 during the like 1936 period, a gain of 17 per cent.

Medal For Wire Goes To Museum

AMERICAN STEEL & WIRE CO. has placed in its industrial museum at Worcester, Mass., a medal and diploma awarded 100 years ago this month to Washburn & Moen Mfg. Co., the establishment which developed eventually into the American Steel & Wire's North works.

Unaccounted for many years, the awards given to Ichabod Washburn, head of the Washburn & Moen company, for the excellence of two boxes of iron wire, came from the Massachusetts Charitable Mechanics Association.

Air Conditioning School Is Opened

WESTINGHOUSE ELECTRIC & MFG. CO. on Oct. 4 opened a month-long air condition application engineering school for distributers at East Springfield, Mass., where company experts and outside engineers will lecture on air conditioning equipment.

Predicting great expansion for the air conditioning industry, S. F. Myers, Westinghouse sales executive, estimates that this new industry will need from 5000 to 7000 young engineers every year until 1947.

Steel Fabricators To Convene Oct. 26

FABRICATORS of structural steel will meet in convention at White Sulphur Springs, W. Va., on Oct. 26, when 300 representatives of firms from nearly every state in the Union will attend the fifteenth annual meeting of the American Institute of Steel Construction.

Building outlook, the progress of research within the industry, and related problems will be discussed by members of the industry and by guest speakers. Thomas H. Beck, president of the Crowell Publishing Co., and Judge Harold B. Wells of the Court of Errors and Appeals of New Jersey, will be speakers at the banquet on Thursday night, Oct. 28.

A feature of the convention will be a forum discussion of the progress made in the building of homes with steel. Fred T. Llewellyn, consulting engineer of the United States Steel Corp., has prepared a report on the use of "Light-Gage, Flat-Rolled Steel in Housing." Builders of different types of houses have been invited to attend and discuss the problem within their experience.

Other speakers on the program are Edward L. Ryerson, Jr., vice-chairman of Inland Steel Co., Chicago; F. E. Schmitt, editor of *Engineering News-Record*, New York; E. J. Russell, architect of St. Louis, Mo.; Henry M. Stevens, vice-president of the J. Walter Thompson Co., New York; H. D. Hussey, American Bridge Co., New York, and C. Oliver Wellington, of McKinsey, Wellington & Co., New York.

The convention will last four days through Friday, Oct. 29.

Trackwork Shipments Gain In September

SHIPMENTS of trackwork for T-rail track of 60 lb. per yd. and heavier rose from 7530 net tons in August to 8101 tons in September, according to the American Iron and Steel Institute. In September, 1936, 5722 tons was shipped. Shipments for the third quarter amounted to 23,883 tons, compared with 27,889 tons for the second quarter, and 26,119 tons for the first. In the third quarter of 1936, 18,339 tons was shipped. For the first nine months, 77,891 tons was shipped, compared with 52,931 tons in the corresponding period in 1936 and 68,813 tons for the whole year. In 1929, shipments amounted to 162,115 tons for the 12 months.

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Sheets: Black, Galvanized, Special Coated, Roofing and Siding—14 Styles
*Trade Mark Registered, U. S. Patent Office

Machine Tool Salesmen in Detroit Meet to Improve Sales Technique

MEMBERS of the Associated Machine Tool Dealers in the Detroit area held a dinner meeting recently at Dearborn Inn, Dearborn, Mich., a novel feature of which was the fact that they invited not only the dealers and salesmen who handle machine tools in that district, but also invited to their dinner the machine tool salesmen who sell direct. With over 150 men present, the meeting represented practically the entire personnel that distribute machine tools in the Detroit territory.

Tell Berna, general manager of the National Machine Tool Builders' Association, spoke of the distinctive character of the machine tool industry that made possible a meeting of that kind. He pointed out that in most industry gatherings, all of those who come are competitors with each other, and that it is sometimes difficult for them to realize how much is to be gained by developing a community of interest. Machine tool builders, however, buy from each other, and consequently are not only competitors but customers and friends, which has developed among machine tool builders a friendly, cooperative atmosphere that might very well be developed among their salesmen as well.

He further stressed the fundamental importance of the machine tool industry in an industrial nation such as ours, pointing out the fact that, although the industry is relatively small compared with other large giants of the American industrial structure, all industries depend upon machine tools for the better machinery and equipment that they must have in order to reduce manufacturing costs, which in turn means keeping down the price to the consumer while at the same time making possible higher wages and shorter hours for those employed by these industries.

Salesmen's Responsibilities

Mr. Berna further pointed out the responsibility of machine tool salesmen, whether they be dealer salesmen or direct salesmen, in furthering an understanding of the importance of the industry and in developing a better sales technique in handling machine tools. We are extremely watchful of manufacturing costs, we are not only prepared to consider changes in the improvement, in the design and manufacture of our machines, but confidently expect these changes and look forward to them as a perfectly normal part of our work, and there is no reason why there should not be a corresponding watchfulness on the cost of selling as well as a readiness to admit that improved sales methods are not only desirable but inevitable and should be given constant consideration by the executives in industry.

The salesman serves a double function. He must not only bring information to the customer, bring it accurately and quickly and in convenient form and must understand his customer's work well enough so that he can cooperate in a constructive way to increase the profits that his customer can earn, but he also serves as a liaison officer to bring to the factory that he

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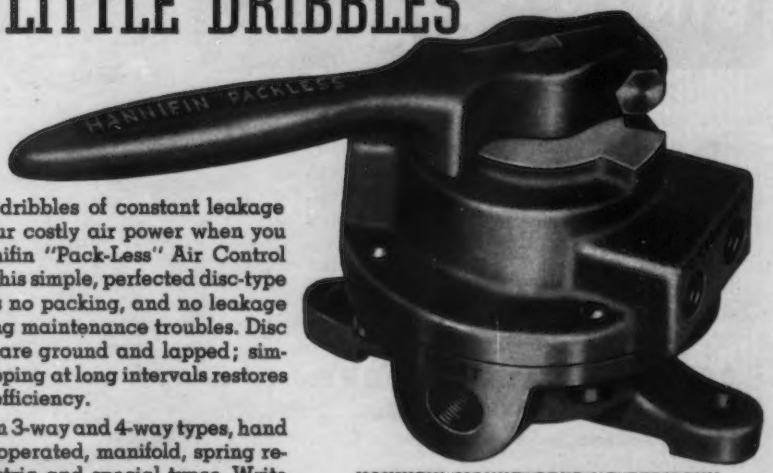

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Made in 3-way and 4-way types, hand and foot operated, manifold, spring return, electric and special types. Write for Valve Bulletin 34-A.

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HANNIFIN "Packless" AIR CONTROL VALVES

represents an understanding of the customer's problem and of the customer's needs and of the actual experience that the customer has had with machine tools after installation, so as to keep the machine tool builder fully informed of conditions in the field.

Mr. Berna closed with the expression of his hope that the dealers would be hosts for still further meetings at which a frank interchange of ideas on an improved sales technique could take place.

..CAST IRON PIPE..

Winston-Salem, N. C., plans pipe lines for water system; also new elevated steel tank and tower. Fund of $31,000 has been arranged. Bond issue of $129,000 is under consideration for similar improvements, including pressure lines, for main water supply.

Port Arthur, Tex., will take bids soon for new 20-in. pipe in Atlanta Avenue, Thomas Boulevard and Nineteenth Street for main water line to cost about $39,300; also 12-in. lines for similar service in part of Nineteenth Street, cost $31,500, and in parts of Atlanta and Austin Avenues, cost about $24,000. New main line will be installed from water reservoir to purification plant, to cost close to $71,000; and new elevated steel tank and tower will cost about $40,000. Bids will be asked soon. M. D. Gates is city consulting engineer. Parsons Pilcher is city manager.

Tucson, Ariz., will take bids soon for about 30,000 ft. of various sizes for water system. Fund of $60,000 has been arranged. P. J. Martin, Jr., is city engineer.

Ontario, Ore., plans 14,590 ft. of 10 to 36-in. pipe for trunk water lines; also pumping machinery and other waterworks installation. L. R. Stockman, Baker, Ore., is consulting engineer.

Seattle, Wash., plans main water line from reservoir in Volunteer Park to Magnolia Bluff district. Cost close to $300,000. N. A. Carle, County-City Building, is engineer.

Spartanburg, S. C., plans 12-in. for main water line, replacing existing 6-in. mains. Cost about $44,000. Financing has been arranged through Federal aid. Public Works Commission, D. W. Hendrix, chairman, in charge.

Pauls Valley, Okla., plans pipe lines for water system. Cost about $26,000. W. B. McMasters, 1724 West Ninth Street, Oklahoma City, Okla., is consulting engineer.

Moulton, Ala., will take bids soon for pipe lines for water system and other waterworks installation. Fund of $30,000 has been secured through Federal loan and grant.

Norfolk, Va., plans 12-in. for extension in main supply line to plant of Ford Motor Co., where service will be furnished. Cost about $12,000.

Los Angeles, Department of Water and Power, has awarded 150 tons of 4 and 6-in. pipe to United States Pipe & Foundry Co.

Lewis Union Calls Convention To Make New Steel Industry Demands

ANNOUNCEMENT this week of plans for the Steel Workers Organizing Committee's first convention, to be held Dec. 14-16 at Pittsburgh, highlighted a period of growing activity on the labor front.

Four months before the expiration of its wage contracts with United States Steel Corp. subsidi-

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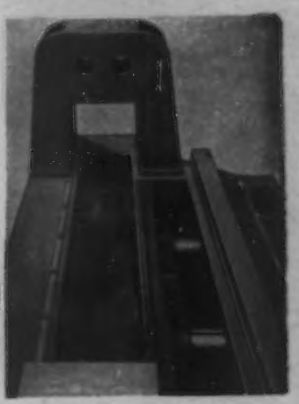

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aries and some other steel companies, the SWOC, agency by which John L. Lewis seeks to unionize all steel plants, declares that the December conference:

1—Will adopt a wage policy to "provide a basis for negotiating wage agreements to succeed those now in effect."

2—Will set up rules for the government of local lodges, which "will tend to bring about the complete unionization of every steel plant in America."

The convention is regarded as an important preliminary to conferences scheduled to begin Feb. 7 between the SWOC and officials of Carnegie-Illinois Steel Corp. regarding the drawing up of a new contract which, if Lewis has his way, may include provisions for the closed shop and the checkoff.

Other developments in labor this week were:

1—Final steps toward expulsion of Lewis' Committee for Industrial Organization "rebel" unions from the American Federation of Labor were taken in the AFL convention at Denver.

2—A declaration by Homer Martin, United Automobile Workers Union leader, that Henry Ford is not "to blame for the working conditions in his plant and does not know how bad they are and what speed-ups and what lack of freedom the workers endure." Mr. Ford has consistently opposed the CIO.

3—In an apparent victory for the AFL, the National Labor Relations Board ruled, in the case of the General Steel Castings Corp., Granite City, Ill., that a minority craft union may be a bargaining agent for workers in a plant where a majority of the workers are members of an industrial (CIO) union.

4—Members of the National Society of Professional Engineers, following conferences with representatives of the American Bar Association and the American Medical Society, met in New York City to combat "coercion" by the CIO and planned to resist organization by the Lewis' forces.

5—Hailing his victory as a defeat for the CIO, Premier Mitchell Hepburn of Ontario and his government were returned to office by a large majority despite opposition of Lewis' supporters.

6—CIO leaders in Detroit, warning that the Lewis organization is "going into politics" throughout the country, placed five of their candidates among 18 nominated for council at that city's recent election.

7—William Green, AFL president, announced that his organization would fight to defeat CIO political candidates on every front.

8—Amid a rising tide of charges that the Wagner Act is biased and the Labor Board pro-CIO, J. Warren Madden, the board's chairman, flatly denied before AFL delegates at Denver that the board favors the CIO in labor controversies. The division between the CIO and AFL is "none of the board's affair," Mr. Madden said.

9—United States Senator A. H. Vandenberg said in an address at New York that the Wagner Act "will not survive its own mistakes if it substitutes new tyrannies for old, nourishes irresponsible strife, interrupts profitable and legitimate commerce, or creates more problems than it solves." Senator Vandenberg said further: "I believe

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labor is right when it demands written contracts at the end of voluntary collective bargaining."

10—Agreements with nine coal shipping companies, calling for wage increases averaging 15 per cent, were signed by the companies and the National Maritime Union, a CIO affiliate. The new contracts, affecting 2240 men on 56 ships, provide for a closed shop, recognition of the NMU as spokesman for the workmen, an 8-hr. day, extra pay for overtime and for certain special types of work, and arbitration of disputes growing out of contract interpretation.

11—The Labor Board succeeded in obtaining a 34-page list of persons and firms in various parts of the country who contributed to the Citizens Committee during the early weeks of the Bethlehem Steel Co. strike at Johnstown, Pa., in June. Two anonymous contributors from New York and Pittsburgh gave $1,000 each, according to George C. Rutledge, Johnstown banker, who served as treasurer of the committee which sought to reopen Bethlehem's strike-bound mills.

12—Efforts by a crowd of men to stimulate payment of delinquent union dues by Jones & Laughlin Steel Corp. employees, sent a riot squad of police to the J. & L. South Side plant at Pittsburgh early this week. Police were slugged when a group of union workmen threatened other workers whose dues are unpaid by telling them they would not be allowed to work until the back dues ($1 monthly) were paid up.

Of chief interest to the steel industry was the preparation for the SWOC convention which is expected to consider, among other issues, the union's defeat in last summer's strike called in plants of Bethlehem Steel Co., Republic Steel Corp., Inland Steel Co. and Youngstown Sheet & Tube Co.

Details of the union's new demands on the United States Steel Corp. subsidiaries, to be made in the conferences scheduled to begin in Pittsburgh, Feb. 7, are expected to be ironed out at the SWOC convention.

Whether the SWOC will, in the face of a declining volume of business and reduction in steel workers' hours of work, request that a wage advance be part of the proposed 1938 wage contract is a matter of speculation. Pressure on Philip Murray, SWOC chairman, and other union leaders will, apparently, force the issues of the closed shop and checkoff—long opposed by steel manufacturers—into the February negotiations with the steel manufacturers.

National Supply Merger Approved

NATIONAL SUPPLY CO. stockholders have approved a plan of recapitalization in which National Supply will merge with Spang, Chalfant & Co. into a new Pennsylvania corporation to be known as the National Supply Co. Spang, Chalfant stockholders were to meet Oct. 13 to approve the plan.

RAILROAD BUYING

The Burlington will build in its own shops five locomotives, 600 steel sheathed box cars, 250 automobile cars, and 400 coal cars. It will purchase 100 ballast cars, and 11 passenger train units, five to be of stainless steel. Bids are being asked Oct. 20 on $3,666,000 worth of equipment trust certificates, total cost to be $4,888,000.

International Harvester Co. has announced removal of its general offices to 180 North Michigan Avenue, Chicago. All business of the general offices will be handled from this address.

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2. Chasers collapse positively by cam and rollers.
3. Chasers quickly removed for grinding and quickly reset without removing cap.
4. Tap can be used for stationary and rotating tapping.

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ARMSTRONG Wrenches are quality wrenches drop forged from special analysis steel, improved in designs, in proportions and balance. They are heat treated, hardened and finely finished in black baked enamel with heads ground bright and plainly marked for size. They are stronger, finer tools, still cost no more than other quality wrenches.

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MONTHLY SHIPMENTS OF FINISHED STEEL PRODUCTS BY UNITED STATES STEEL CORP.—TONS

Month	1933 Shipments	1933 Per Cent of Capacity	1934 Shipments	1934 Per Cent of Capacity	1935 Shipments	1935 Per Cent of Capacity	1936 Shipments	1936 Per Cent of Capacity	1937 Shipments	1937 Per Cent of Capacity
January	285,137	17.7	331,777	19.8	534,055	31.9	721,414	44.8	1,149,918	*75.4
February	275,929	18.5	385,500	25.9	583,137	39.2	676,315	45.3	1,133,724	82.5
March	256,793	15.3	588,209	35.2	668,056	41.5	783,552	50.5	1,414,399	92.7
April	335,321	21.6	643,009	41.5	591,728	36.7	979,907	63.2	1,343,644	91.0
May	455,302	27.1	745,063	44.5	598,915	35.8	984,097	63.4	1,304,039	85.5
June	603,937	37.4	985,337	61.2	578,108	36.7	886,065	57.1	1,268,550	85.8
July	701,322	45.1	369,938	23.9	547,794	34.0	950,851	61.3	1,136,752	77.9
August	668,155	39.8	378,023	22.6	624,497	37.3	923,703	59.6	1,107,858	72.6
September	575,161	35.6	370,306	23.9	614,933	39.7	961,803	62.0	1,047,962	71.1
October	572,897	35.5	343,962	20.6	686,741	41.1	1,007,417	62.6	.....	.
November	430,358	26.7	366,119	22.7	681,820	42.3	882,643	59.2	.....	...
December	600,639	38.7	418,630	27.0	661,515	42.7	1,067,365	68.8	.....	...
Plus or minus yearly adjustment	(+44,283)	...	(—19,907)	...	(—23,750)	...	(—40,859)	...	.....	...
Total for year	5,805,235	30.1	5,905,966	30.6	7,347,549	38.1	†10,784,273	58.2	.....	...

* Annual capacity 17,929,400 gross tons, with monthly percentages based on actual number of weeks in each month.
† Adjusted.

U. S. Steel Shipments Taper In September

FINISHED sheet shipments by United States Steel Corp. subsidiaries for September totaled 1,047,962 tons, off slightly from the August total of 1,107,858 tons but still the highest for any September since 1929 when shipments were 1,145,244 tons.

September shipments, 59,896 tons under August, ran 86,159 tons above September, 1936, and were 71.1 per cent of capacity. For the first nine months of 1937 shipments of finished steel products were 3,089,139 tons or 39 per cent above those for the comparable 1936 period.

FABRICATED STEEL

NORTH ATLANTIC STATES

Deer Isle-Sedgwick, Me., 1300 tons, State bridge, to Phoenix Bridge Co., Phoenixville, Pa.

Pittsfield, Mass., 450 tons, General Electric Co. unit, to American Bridge Co.

Eastport-Perry, Me., 160 tons, State highway beam spans, to Bethlehem Steel Co.

COMMERCIAL
SPECIALISTS in Tank Heads. Commercial Heads are formed cold, in solid dies, insuring uniformity, and close tolerance in diameter and circumference. A Quality Product at no premium in price.
WE ALSO MANUFACTURE heavy and medium gauge stampings, in steel and other metals and alloys.
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● TANK ACCESSORIES ●
● BOILER HEADS ●
● STAMPINGS ●
THE COMMERCIAL SHEARING AND STAMPING COMPANY
YOUNGSTOWN · OHIO · U·S·A·

Cambridge, Mass., 410 tons, extension to Massachusetts Institute of Technology, to New England Structural Co., Everett, Mass.

Westport, Conn., 230 tons, Saugatuck River bridge, to American Bridge Co.

Long Beach, Long Island, 125 tons, bridge repairs, to American Bridge Co.

Belle Isle (near Syracuse), N. Y., 495 tons, New York Central grade crossing, to American Bridge Co.

Niagara Falls, N. Y., 200 tons, theater, to R. S. McMannus Steel Construction Co., Buffalo.

Upper Darby, Philadelphia, 450 tons, grade school, to Fort Pitt Bridge Works Co., Pittsburgh.

Pittsburgh, 850 tons, stock house for Duquesne Brewing Co., to Pittsburgh-Des Moines Steel Co., Pittsburgh.

Carderock, Md., 250 tons, ship model test plant, to Belmont Iron Works, Philadelphia.

THE SOUTH

Washington, Ga., 1010 tons, bridge, to Nashville Bridge Co., Nashville, Tenn.

Marlboro-Chesterfield Counties, S. C., 240 tons, bridge, to Carolina Steel & Iron Co., Greensboro, N. C.

Hampton-Beaufort Counties, S. C., 150 tons, to Carolina Steel & Iron Co.

CENTRAL STATES

Muskegon, Mich., 725 tons, foundry and warehouse, Sealed Power Corp., to R. C. Mahon Co., Detroit.

Milford, Mich., 180 tons, Ford Motor Co. factory building, to R. C. Mahon Co., Detroit.

Flint, Mich., 530 tons, buildings for Buick Motor Car Co., to Flint Structural Steel Co., Flint.

Detroit, 300 tons, Chrysler Corp. extension to building No. 21, to Whitehead & Kales Co., Detroit.

Cincinnati, 120 tons, Pennsylvania Railroad engine house, to L. Schrieber & Sons Co., Cincinnati.

Niles, Ohio, 140 tons, State highway bridge, TR-422-159, to Truscon Steel Co., Youngstown.

North Manchester, Ind., 120 tons, State bridge, to Midland Structural Steel Co., Cicero, Ill.

Evanston, Ill., 200 tons, post office, to Bethlehem Steel Co.

Manitowoc, Wis., 150 tons, two bridges, to Wausau Iron Works, Wausau, Wis.

Fort Madison, Iowa, 175 tons, alteration to du Pont paint plant, to Bethlehem Steel Co.

Cold Spring, Minn., 325 tons, cutting shed for Cold Spring Granite Co., to Minneapolis-Moline Power Implement Co., Minneapolis.

Omaha, Neb., 120 tons, Union Pacific bridge, to American Bridge Co.

WESTERN STATES

Denver, 500 tons, grade crossing, to Bethlehem Steel Co.

Denver, 130 tons, Montgomery Ward warehouse, to Midwest Steel & Iron Works Co., Denver.

Pierce County, Wash., 240 tons, Nasel River bridge, to Pacific Car & Foundry Co., Seattle.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Richmond, Me., 250 tons, State bridge.

Cambridge, Mass., 450 tons, building extension for Lever Brothers Co.

New York, 180 tons, curb angles, Henry Hudson Parkway.

New York, 60,000 tons, estimated, midtown Manhattan underpass. Plans to be submitted to Board of Estimate for approval on Oct. 17.

Long Island City, N. Y., 300 tons, machine shop, John Simmons Co.

Glenwood Landing, N. Y., 380 tons, turbo generator supports, Long Island Lighting Co.

Greenburgh, N. Y., 300 tons, school buildings, New York School for Deaf.

Maspeth, N. Y., 1100 tons, factory building, Circle Wire & Cable Co.

Binghamton, N. Y., 110 tons, Westcott department store.

Kennedy, N. Y., 153 tons, grade crossing elimination; bids Oct. 14.

Mantoloking, N. J., 150 tons, bridge; bids Oct. 27.

Harrisburg, Pa., 5000 tons, Finance building; bids Nov. 3. Previously reported Hamburg, Pa.

Philadelphia, 150 tons, addition to building for Reyburn Mfg. Co.; bids in.

Fairview, Pa., 250 tons, hospital; bids in.

Parkhead, Md., 340 tons, State bridge over Licking Creek.

THE SOUTH

Lubbock, Tex., 350 tons, library.

CENTRAL

River Rouge, Mich., 3000 tons additional, press building for Ford Motor Co.

Cincinnati, 330 tons, Kemper Lane viaduct.

Cleveland, 100 tons, factory addition, Bailey Meter Co.

Lake County, Ind., 175 tons, bridge; new bids Oct. 22.

Clinton County, Ill., 685 tons, highway bridge; Vincennes Bridge Co., Vincennes, Ind., low bidder.

Pulaski County, Ill., 115 tons, highway bridge; Hansell-Elcock Co., Chicago, low bidder.

St. Louis, 100 tons, women's building for Masonic Home; Koerner Engineering Co., Engineer, St. Louis; bids due Oct. 26.

Kansas City, Mo., 550 tons, bridge over Blue River for Kansas City Terminal Railway; bids rejected and new bids to be asked.

Kansas City, 400 tons, Montgomery-Ward building.

Chadron, Neb., 150 tons, State bridges.

Belvidere, Neb., 150 tons, State bridge and viaduct.

FABRICATED PLATES

AWARDS

Baltimore, 195 tons, welded tanks for Procter & Gamble Co., to Hammond Iron Works, Warren, Pa.

NEW PROJECT

River Rouge, Mich., 3000 tons, flooring in press building, Ford Motor Co.

SHEET PILING

NEW PROJECTS

Pittsburgh, 650 tons, Hiland Park bridge; bids Oct. 15.

Los Angeles, 273 tons, for United States Engineers; bids open.

WESTERN STATES

State of Nevada, 650 tons, all American Canal; contract 980D, 250 tons, bids Oct. 22; Contract 981D, 400 tons, bids Oct. 25.

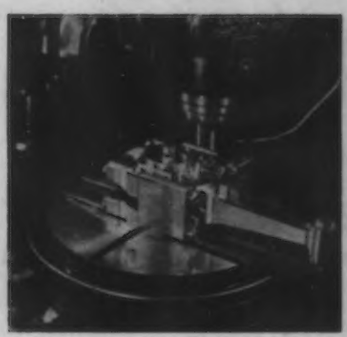
Denver, 106 tons, State highway construction; bids Oct. 18.

Los Angeles, 1200 tons, Metropolitan Water District; bids to be opened Nov. 8, alternate bids to be taken on pipe.

Seattle, Wash., 800 tons, hangar for Sandpoint airport, Belmont Iron Works, Philadelphia, low bidder.

ALL IN THE DAY'S WORK

at TAFT-PEIRCE



MASTER ROD OF AIRCRAFT MOTOR being milled in Manufacturing Dept. Here, high precision parts of all types are turned out "on the button."

LINE BORING a universal crankshaft checking fixture on 1 of 8 horizontal boring mills. No job too small or too large for the Manufacturing Dept.

A FUSSY JOB on one of a battery of jig borers in the Toolroom — equipped and manned to turn out tools, dies, jigs and fixtures.

HIGH SPEED PRECISION DRILLS work on many jobs at once in the Manufacturing Department . . . where parts or complete assemblies are built to your blueprints.

MODERN HEAT TREATING DEPARTMENT — 10,000 sq. ft. of floor space, 100% electric operation, all types of furnaces equipped with automatic temperature control.

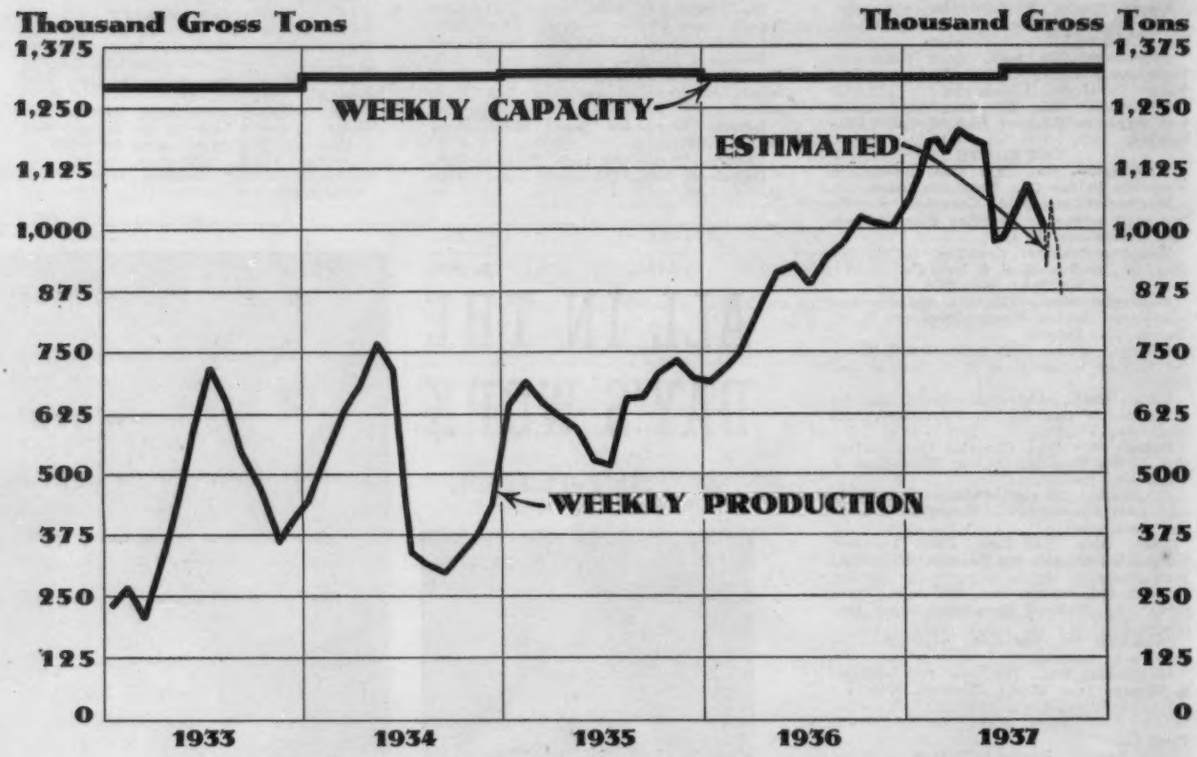
THE TAFT-PEIRCE MANUFACTURING CO.

WOONSOCKET, R. I.

Take it to TAFT-PEIRCE for Contract Manufacture, Design, Tooling, Gages, Set-Up and Inspection Tools

PRODUCTION

Average Weekly Production of Open-Hearth and Bessemer Steel Ingots by Months, 1933-1937, and Estimated Production by Weeks in 1937



Figures for the Current Week Are Not Indicated on the Chart Until the Following Week

STEEL INGOT PRODUCTION BY DISTRICTS: Per Cent of Capacity

	Current Week	Last Week
Pittsburgh	60.0	61.0
Chicago	56.5	64.5
Valleys	60.0	60.0
Philadelphia	54.0	60.0
Cleveland	69.0	65.0
Buffalo	71.5	71.5
Wheeling	77.0	75.0
Southern	55.0	62.0
Ohio River	76.0	76.0
Western	65.0	65.0
St. Louis	63.0	67.0
Detroit	90.0	95.0
Eastern	76.0	62.0
Aggregate	63.5	66.0

Weekly Booking of Construction Steel

	Week Ended				Year to Date	
	Oct. 12, 1937	Oct. 5, 1937	Sept. 14, 1937	Oct. 13, 1936	1937	1936
Fabricated structural steel awards	10,275	7,900	19,120	14,000	874,385	859,830
Fabricated plate awards	195	1,620	590	6,415	88,730	189,925
Steel sheet piling awards	0	580	0	2,545	42,430	44,730
Reinforcing bar awards	8,025	4,400	6,970	4,300	225,655	283,220
Total Lettings of Construction Steel	18,495	14,500	26,680	27,260	1,231,200	1,377,705

. . . .SUMMARY OF THE WEEK. . . .

. . . Adjustment of steel operations to demand believed virtually completed.

o o o

. . . Automobile production schedules are rapidly increasing.

o o o

. . . Steel prices hold firm; export buying gains; scrap at new low.

THAT adjustment of steel production to the current small volume of hand-to-mouth buying has been virtually completed is indicated by events this week. In the Wheeling area, where sheet and strip capacity is an important factor, there has been a rise of two points to 77 per cent in the average operating rate, while in the Cleveland-Lorain district an increase of four points to 69 per cent is occasioned by the resumption of two open-hearth furnaces in a plant where several furnaces have been idle for weeks owing to installation of new equipment.

Aside from these increases, the general trend has been downward, sharply so in the Chicago district, where the rate has dropped eight points to 56½ per cent of capacity, accompanied by the blowing out of three steel company blast furnaces. In the Pittsburgh district a further decline of only one point to 60 per cent is believed to have placed operations approximately in line with current buying. Production has dropped no further at Youngstown, but is down six points to 54 per cent in eastern Pennsylvania, a reflection of lower bookings of plates and structural shapes, of which that area is an important producer. These, with some minor losses in other districts, bring the country's average rate down this week to 63½ per cent from 66 per cent last week.

In keeping with reduced mill production, scrap prices have declined to the lowest of the year. THE IRON AGE scrap composite price, at $16.25, is 66c. below last week's level and has gone back to the figure of early December, 1936.

SOME steel companies estimate that their current shipments are about 15 per cent in excess of incoming orders. Thus a moderate increase in new business would about strike a balance between present production rates and demand. Buying by the automobile companies is still disappointing. The orders placed a week or so ago by General Motors and Chrysler have not been followed by any other substantial buying. However, the Ford Motor Co. is in the market for steel for 125,000 cars and is expected to buy soon, as pilot cars will be rolled off its assembly line next week and a schedule of 255,000 units within 40 days has been set up. Chevrolet, now in production, has scheduled 204,000 cars to be completed by Dec. 1, of which 85,000 will be built this month. Total production for the industry, which was nearly 72,000 units last week, is expected to reach 100,000 a week by the end of the month. Both Ford and Chevrolet schedules are heavier than a year ago.

Renewed hope for some railroad buying, despite the delayed decision of the Interstate Commerce Commission on freight rates, has come from the announcement that the Burlington will build in its own shops equipment to cost $4,888,000, consisting of five locomotives and 1250 freight cars, and will buy 100 ballast cars and a number of passenger cars, including some of stainless. With steel for building construction in light volume, the prospective purchase of 60,000 tons of structural steel and liner plates for the Midtown tunnel in New York is attracting attention.

Export buying has increased materially and a great many inquiries are still under negotiation, the stumbling block being a difference of views as to prices. European buyers have obtained some concessions. A reconciliation of price differences undoubtedly would result in considerably more business here, particularly in ingots and semi-finished steel. The importance of export buying at this juncture is illustrated by the report of the National Machine Tool Builders' Association for September, which shows a gain in the sales index to 210.7 from 179.8 in August, mostly due to foreign orders, domestic buying having declined slightly.

STEEL companies have taken a firm stand against price concessions, which some buyers have been urging. Present high labor and other costs are cited as necessitating the maintenance of the present price schedules. Moreover, legal counsel of some steel companies have ruled that secret concessions might be a violation of the Robinson-Patman Act if not immediately extended to all buyers alike, and no company, under present conditions, is likely to announce an open price reduction. An early reaffirmation of present prices for the first quarter, which some expect in line with recent precedent, might tend to convince buyers as to price stability. Seamless pipe in sizes ½ in. to 1½ in. has been advanced from $6 to $10 a ton, effective Oct. 1.

Ingot output in the nine months ended Sept. 30 totaled 42,498,769 gross tons. An average output of 68½ per cent of capacity would be required during this quarter to exceed the record-breaking production of 54,312,279 tons of open-hearth and bessemer ingots in 1929.

. . . PITTSBURGH . . .

. . . Ingot rate declines slightly at Pittsburgh, up in Wheeling area.

o o o

. . . Production possibly scraping bottom, though new business is not gaining.

o o o

. . . Finished steel prices show no signs of weakness.

PITTSBURGH, Oct. 12.—Total finished steel sales in the past week were about on a par with the previous two periods. While some improvement was noted in sheet, wire and hot rolled bar specifications, a decline occurred in semi-finished steel and plate and shape bookings.

That producers as a whole have practically adjusted their ingot rates to incoming business is borne out by a drop of only one point in the Pittsburgh district ingot output this week to 60 per cent of capacity. Wheeling district steel operations have advanced two points to 77 per cent of capacity.

There is little doubt that steel purchased in practically all cases is now on a hand-to-mouth basis, with the result that economical rolling schedules will be rather difficult to execute. While buying from the automobile trade has been more active in recent weeks, it is still below what producers had expected, and it is thought in some quarters that auto makers will determine public reaction toward higher car prices before substantial steel tonnages are placed.

Steel producers in this district are still of the opinion that a better volume of buying will materialize before the end of the year, but their present expectations are somewhat milder than the ones held a few months ago. The belief in some quarters that lower steel prices are in the offing is not borne out by the facts. In all cases except reinforcing bars, finished steel prices have not only been firm but show no signs of softening. Relatively speaking, reinforcing bar prices are strong as this product has always followed a more or less irregular price trend. Current realized prices on concrete bars, while below published quotations in some cases, are materially above those obtained a year ago.

Should present steel prices be reaffirmed for first quarter delivery in line with the policy adopted some time ago, when second quarter quotations were named for third and fourth quarter shipments, the question of steel prices will at least be settled for the first three months of 1938. Whether some makers will soon announce their intentions concerning first quarter quotations is not definitely known, but such an announcement in the near future would not be surprising.

Pig Iron

Merchant pig iron sales and releases so far this month have been a shade better than in the corresponding September period. Some consumers who have been drawing heavily on their inventories have found it necessary to reenter the market for small tonnages. Demand for steel-making iron is quite dull owing to reduced ingot operating schedules. The leading independent steel producer has taken two blast furnaces out of operation during the past week while a smaller independent has blown in a furnace which has been idle for the last few months.

Bars

Hot rolled bar sales within the past week have shown signs of improvement, causing bookings so far this month to be ahead of the corresponding September period. Most of this improvement is due to slightly better automotive buying but a portion is also emanating from farm implement makers. Miscellaneous demand continues dull, although it is thought that consumers in some cases are making serious inroads on their inventories. Although automotive buying is slightly more active, tonnages placed are not large but increases are expected when car production schedules get well under way.

Semi-Finished Steel

Semi-finished steel demand has declined somewhat during the past week compared with the previous period. Tonnages booked so far this month are somewhat under average bookings placed a few months ago. Demand for sheet bars from non-integrated makers has declined rather sharply recently.

Cold Finished Bars

Cold finished bar business has improved slightly, with most of the increase being due to automotive buying. The tonnages involved in the latter purchases, however, are smaller than had been anticipated. Miscellaneous buying continues dull and jobber demand is almost non-existent. Some refrigerator buying has materialized in recent weeks.

Reinforcing Bars

Carnegie-Illinois Steel Corp. has been awarded the contract for 3200 tons of concrete bars for section No. 3 of the Baby Creek sewer project, Detroit. The closing of this contract virtually completes the unusually large tonnages involved in the Detroit sewer project. New business is slowing up, which is not unusual for this time of the year.

Plates and Shapes

Structural plate and shape specifications have declined somewhat in the past week. While inquiries and awards are fairly numerous, tonnages involved are somewhat smaller than was the case earlier in the year. There still continues to be a fair amount of privately financed projects, however, representing for the most part factories and plant extensions. Pittsburgh-Des Moines Steel Co., Pittsburgh, was awarded the contract for a brewing company stock house at Pittsburgh, involving 850 tons of plates and shapes.

Steel Sheet Piling

New projects are slow in materializing and current demand continues rather dull. The Hiland Park bridge across the Allegheny River at Pittsburgh will require

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics

Rails and Semi-finished Steel

Per Gross Ton:	Oct. 12, 1937	Oct. 5, 1937	Sept. 14, 1937	Oct. 13, 1936
Rails, heavy, at mill	$42.50	$42.50	$42.50	$36.37½
Light rails, Pittsburgh	43.00	43.00	43.00	35.00
Rerolling billets, Pittsburgh	37.00	37.00	37.00	32.00
Sheet bars, Pittsburgh	37.00	37.00	37.00	32.00
Slabs, Pittsburgh	37.00	37.00	37.00	32.00
Forging billets, Pittsburgh	43.00	43.00	43.00	39.00
Wire rods, Nos. 4 and 5, P'gh	47.00	47.00	47.00	40.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	2.10	2.10	2.10	1.80

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	2.45	2.45	2.45	2.05
Bars, Chicago	2.50	2.50	2.50	2.10
Bars, Cleveland	2.50	2.50	2.50	2.10
Bars, New York	2.78	2.78	2.78	2.40
Plates, Pittsburgh	2.25	2.25	2.25	1.90
Plates, Chicago	2.30	2.30	2.30	1.95
Plates, New York	2.53	2.53	2.53	2.19
Structural shapes, Pittsburgh	2.25	2.25	2.25	1.90
Structural shapes, Chicago	2.30	2.30	2.30	1.95
Structural shapes, New York	2.5025	2.5025	2.5025	2.16¼
Cold-finished bars, Pittsburgh	2.90	2.90	2.90	2.35
Hot-rolled strips, Pittsburgh	2.40	2.40	2.40	1.95
Cold-rolled strips, Pittsburgh	3.20	3.20	3.20	2.60
Hot-rolled annealed sheets, No. 24, Pittsburgh	3.15	3.15	3.15	2.60
Hot-rolled annealed sheets, No. 24, Gary	3.25	3.25	3.25	2.70
Sheets, galv., No. 24, P'gh	3.80	3.80	3.80	3.20
Sheets, galv., No. 24, Gary	3.90	3.90	3.90	3.30
Hot-rolled sheets, No. 10, Pittsburgh	2.40	2.40	2.40	1.95
Hot-rolled sheets, No. 10, Gary	2.50	2.50	2.50	2.05
Cold-rolled sheets, No. 20, Pittsburgh	3.55	3.55	3.55	3.05
Cold-rolled sheets, No. 20, Gary	3.65	3.65	3.65	3.15
Wire nails, Pittsburgh	2.75	2.75	2.75	2.05
Wire nails, Chicago dist. mill	2.80	2.80	2.80	2.10
Plain wire, Pittsburgh	2.90	2.90	2.90	2.50
Plain wire, Chicago dist. mill	2.95	2.95	2.95	2.55
Barbed wire, galv., P'gh	3.40	3.40	3.40	2.55
Barbed wire, galv., Chicago dist. mill	3.45	3.45	3.45	2.60
Tin plate, 100-lb. box, P'gh	$5.35	$5.35	$5.35	$5.25

On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

Pig Iron

Per Gross Ton:	Oct. 12, 1937	Oct. 5, 1937	Sept. 14, 1937	Oct. 13, 1936
No. 2 fdy., Philadelphia	$25.76	$25.76	$25.76	$21.3132
No. 2, Valley furnace	24.00	24.00	24.00	19.50
No. 2, Southern Cin'ti	23.69	23.69	23.69	19.44
No. 2, Birmingham†	20.38	20.38	20.38	15.88
No. 2, foundry, Chicago*	24.00	24.00	24.00	19.50
Basic, del'd eastern Pa.	25.26	25.26	25.26	20.8132
Basic, Valley furnace	23.50	23.50	23.50	19.00
Malleable, Chicago*	24.00	24.00	24.00	19.50
Malleable, Valley	24.00	24.00	24.00	19.50
L. S. charcoal, Chicago	30.04	30.04	30.04	25.7528
Ferromanganese, seab'd, carlots	102.50	102.50	102.50	75.00

† This quotation is subject to a deduction of 38c. a ton for phosphorus content of 0.70 per cent or higher.
*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	*$17.25*	$17.75	$20.75	$18.00
Heavy melting steel, Phila.	*16.75*	17.25	19.25	15.75
Heavy melting steel, Ch'go	*14.75*	15.75	18.00	16.25
Carwheels, Chicago	17.25	17.25	19.25	16.50
Carwheels, Philadelphia	*19.25*	20.25	20.75	16.75
No. 1 cast, Pittsburgh	18.75	18.75	19.75	16.25
No. 1 cast, Philadelphia	*19.25*	20.25	20.25	16.75
No. 1 cast, Ch'go (net ton)	13.50	13.50	14.75	14.00
No. 1 RR. wrot., Phila.	19.75	19.75	20.75	15.75
No. 1 RR. wrot., Ch'go (net)	*13.75*	13.75	15.75	14.25

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$4.25	$4.25	$4.25	$3.75
Foundry coke, prompt	5.00	5.00	5.00	4.25

Metals

Per Lb. to Large Buyers:	Oct. 11			
	Cents	Cents	Cents	Cents
Electrolytic copper, Conn.	*12.00*	12.50	14.00	9.75
Lake copper, New York	13.125	13.125	14.12½	9.87½
Tin (Straits), New York	*54.00*	55.75	59.75	44.62½
Zinc, East St. Louis	*6.25*	6.50	7.25	4.85
Zinc, New York	*6.60*	6.85	7.60	5.22½
Lead, St. Louis	5.85	5.85	6.35	4.45
Lead, New York	6.00	6.00	6.50	4.60
Antimony (Asiatic), N. Y.	18.50	18.25	18.25	12.50

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Oct. 12, 1937	2.605c. a Lb.	$23.25 a Gross Ton	$16.25 a Gross Ton
One week ago	2.605c.	23.25	16.91
One month ago	2.605c.	23.25	19.33
One year ago	2.197c.	18.73	16.67

Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strip. These products represent 85 per cent of the United States output.

Based on average of basic iron at Valley furnaces and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Steel Scrap High	Steel Scrap Low
1937	2.605c., Mar. 9	2.330c., Mar. 2	$23.25, Mar. 9	$20.25, Feb. 16	$21.92, Mar. 30	$16.25, Oct. 12
1936	2.330c., Dec. 28	2.084c., Mar. 10	19.73, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.130c., Oct. 1	2.124c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, April 23
1934	2.199c., Apr. 24	2.008c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., Apr. 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.42, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 5	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., Apr. 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	12.92, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

650 tons of steel sheet piling. Bids will be taken on Oct. 15.

Tin Plate

Tin plate operations this week may be estimated at 90 to 94 per cent. Specifications for fourth quarter delivery are in fair volume. Some miscellaneous consumers appear to have fair-sized inventories. The tomato pack this year was somewhat smaller than anticipated owing to unfavorable weather conditions toward the end of the season.

Sheets

Sheet bookings during the past week showed a considerable improvement from the previous period. The increases were largely attributable to more active automotive buying, although refrigerator makers accounted for a small part of the improvement. Sheet producers are looking forward to heavier commitments from automobile manufacturers but some sources do not expect a change for the better until the public's reaction toward higher car prices is ascertained. Miscellaneous buying continues at low ebb and ultimate consumption is considered to be ahead of incoming business from these sources.

Wire Products

Total wire business is holding up exceptionally well and orders in the past week, if anything, are ahead of the previous periods. Manufacturers' wire specifications are in fair volume. Although jobbers are not coming into the market in a big way, the number of orders and amount of tonnage are showing an increase. Meanwhile, merchant wire stocks are being heavily drawn upon by jobbers who appear to be ordering only when absolutely necessary.

Strip

Specifications for hot and cold rolled strip are a trifle better than a week ago but most mills are badly in need of tonnages. With better sheet specifications from the automotive industry reaching mills, strip producers expect that strip bookings from this source will materialize shortly. Miscellaneous purchases continue on a hand-to-mouth basis.

Tubular Goods

Small seamless pipe, ranging from ½ to 1½ in., was advanced $6 to $10 a ton, effective Oct. 1. Discounts of ½ and ¾ in. seamless pipe were reduced five points, making an increase in price of approximately $10 a ton; discounts on 1 in. and 1¼ in. were reduced 4½ points making an increase in price of approximately $9 a ton; and discounts on 1½ in. were reduced three points, making the price increase approximately $6 a ton. Oil-country goods specifications show little change from a week ago and backlogs at most mills have declined further. Producers are still building up mill and warehouse stocks.

Coal and Coke

Beehive coke producers have practically adjusted production to demand, with the result that little or no distress coke is on the market. Beehive foundry coke demand declined somewhat during the past week, while furnace beehive coke production has been increased slightly owing to the blowing in of a blast furnace in this district.

...Automotive demand not up to expectations.

CINCINNATI, Oct. 12.—Sheet steel demand in this area receded the past week from the previous upward spurt. Mill interests point particularly to the failure of automotive ordering to reach anticipated levels. General demand, however, is holding to recent levels. Mill operations are curtailed since backlogs have been reduced to the place where schedules are becoming more and more dependent upon fresh bookings. Some interests are running finishing departments at a 60 per cent level while others are nearer 80.

Ingot steel production is on a parity with mill operations. Current figures indicate an average of about 74 per cent with 25 out of 34 open hearths in use. However, one interest is operating less than half of its available furnaces.

The pig iron market displays a more reluctant buyer attitude. New business the past week was confined to small spot orders. Melters are adopting more careful buying policies since foundry demand is easier than a month ago. Machine tool foundries remain in fairly active condition, while agricultural implement melters are easing from earlier peaks.

... Pig iron deliveries continue in arrears; ore and coke prices advancing.

LONDON, Oct. 12. (*By Cable*).—United Kingdom pig iron production during September amounted to 726,600 tons and steel amounted to 1,163,000 tons.

Pig iron supplies have been augmented by Canadian arrivals, but producers are still rationing regular customers and deliveries are continuing in arrears. It has been ascertained that the average selling price for Cleveland foundry iron last quarter was 75s. 0.43d, whereas the selling price was fixed at 100s. three months ago. This shows that makers are yet to benefit from the rise in prices. New business is still very difficult to negotiate. Ore and coke are advancing.

Increased arrivals of Continental semi-finished steel are expected this month. Meantime rerollers are operating irregularly. Export steel is quiet, but home demand is active and it is impossible to buy plates and sheets for this year's delivery. Glasgow dock workers are refusing to handle cargoes destined for Japan.

Continental iron and steel are quiet and buyers are hesitant. September bookings at Belgian works amount to 107,000 tons, of which 44,000 tons was for export.

Tin plate is easier because of the recent decline in tin, and buyers are hesitant. Works are well sold. Production is about 76 per cent. Unfilled orders are a trifle under 5,500,000 base boxes. Black and galvanized sheets are dull.

Employment Up In New York Plants

EMPLOYMENT in New York state factories in September was 1 per cent above August and payrolls were 1 per cent lower, according to Industrial Commissioner Elmer F. Andrews. Metal and machinery industries employed 1.6 per cent more men in September than in August while railroad equipment and repair shop showed a loss of 1.4 per cent. Stone, clay and glass products industries employed 2 per cent more men last month.

. . . . CHICAGO . . . .

. . . Burlington road to spend $4,888,000 on new equipment in own shops.

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. . . Automobile demand has not materialized in expected volume.

o o o

. . . Steel operations reduced to 56½% average; three blast furnaces taken off.

CHICAGO, Oct. 12. — Ingot output fell eight points this week to 56½ per cent of capacity following further substantial reductions in operating schedules at two district mills.

The best news in this district for some time is the announcement by the Burlington Road of a $4,880,000 equipment program, which will include the building in its own shops of five locomotives, 600 box cars, with sides and frames of high-tensile steel, 250 automobile cars, and 400 coal cars. The company will purchase 100 ballast cars, three dining and three chair cars for the Aristocrat, two stainless steel dinette coaches and two stainless steel sleeping cars for the Denver Zephyr, and one stainless steel coach for the original Zephyr. Bids will be taken Oct. 20 on $3,666,000 of 2½ per cent equipment trust certificates, due in one to 10 years.

This program is the first major buying move on the part of any railroad since operating expenses were increased by the recent granting of wage advances. It is commonly known that a railroad's net income governs its purchasing program, and it has been estimated that a freight rate increase of 10 per cent will be necessary to build up carriers' net revenues to the point where large-scale purchases are possible. In addition, of course, general business conditions must be sound or the volume of carloadings will be insufficient to benefit the net regardless of the rates charged. It may be that dire need for equipment on nearly all roads will force buying before the granting of the rate increases, as was the case with the Burlington.

Steel producers will support whatever action is necessary to get the railroads back into the steel market, as the hole left when these important customers decrease their purchases is a difficult one to fill.

Sales are less than last week, although in most offices the reduction is small. Automotive demand has not yet materialized in expected volume, but all are confident that releases from this industry will assume normal proportions before the end of the month. Assembly lines, according to advance reports from manufacturers, are being geared for increases in production.

In spite of the current lag in business, and the occasional temptations offered to salesmen in the way of large tonnages at a concession in price, the firmness of the present price structure is being emphasized strongly by all sellers here. The difficulty of favoring one customer over another as regards price is pointed out, as well as the fact that profits come with volume, and that without volume, as is now the case, prices must be maintained.

The decrease in mill activity has necessitated laying off or providing only part-time work for thousands of men in the mills here. South Works of Carnegie-Illinois Steel Corp. took off two more blast furnaces last week, while Gary blew out one stack, leaving in blast five at South and seven at Gary. Open-hearth operations at the two plants were also reduced, as well as at another district mill.

The Progressive Steel Workers' Union, independent group at Wisconsin Steel Works, last week presented membership evidence of more than 80 per cent of the employees and was accordingly recognized as sole bargaining agent for all of the employees by the company.

Pig Iron

Shipments of pig iron and foundry coke are greater than for the corresponding period in September, but this trend is not particularly significant because of the Labor Day shutdowns last month. October iron shipments are even expected to be less than last month by some sellers, although the melt will probably be maintained, if not increased. Activity in foundries casting for the automobile companies is considerably below that expected at this time. Inventories are considered about normal, but they are being reduced constantly. Only spot business is being received, and this consists almost entirely of carload amounts.

Plates

Lacking the stimulus of railroad specifying, and reflecting the only fair operations of tank builders, the plate market continues dull this week. Deliveries are prompt. Prices are firm. Steel buying for car repairing is falling off, and many men are being laid off by the carriers in an effort to reduce their operating overhead following the wage increases, and pending the decision of the I. C. C. as to their petitions for rate boosts. A substantial tonnage of plates is expected to be needed soon for the penstocks of Grand Coulee Dam. The Burlington is negotiating for equipment trust notes to finance the building of five locomotives and 1550 cars, and the purchase of 11 cars for dining or passengers.

Structural Shapes and Reinforcing Bars

A stagnant condition prevails in the construction field here. A warehouse and foundry in Muskegon, Mich., to require 735 tons of shapes, is the largest pending project reported, while no awards over 100 tons were made in this immediate district. A Chicago building which will take about 350 tons of reinforcing steel, and a highway project on Roosevelt Road, Chicago, to require the same amount of bars, are the most important propositions before the trade here currently. Shape prices are reported to be firm, while the usual amount of shading by distributors is in progress on reinforcing bar contracts.

Wire and Wire Products

With the automobile makers still not in the market heavily for wire products, sellers continue to count

most on manufacturers of farm equipment, whose operations and specifications have been at a high rate all summer and give promise of continuing so for some time to come. Farmers have not yet cleared their fields sufficiently to begin their fall buying programs for rehabilitation. General conditions in wire are unsatisfactory at the moment, production exceeding consumption by far, but sellers expect much better business the last part of the month than in the first half.

Sheets

With rollers of sheets suitable for the automotive industry still reporting no appreciable increase in specifications from that source, activity in this flat rolled product remains slight. Deliveries of cold rolled and hot rolled annealed may be had in two to three weeks, hot rolled, one to two weeks, and galvanized three weeks. Releases are fairly constant from stove and refrigerator makers, but the volume is unimpressive. Automobile company buying, slow as it has been in developing, is sure to come and all indications are that this movement is getting under way in earnest at the present time, and will be in full swing within a few weeks.

Bars

Bars, along with sheets, strip and wire, are suffering from the prolonged absence from the market of motor car manufacturers.

. . . Slowing down of steel output affecting employment.

BUFFALO, Oct. 12.—A general slowing up is apparent in all departments of the iron and steel business. Although operation of open-hearth furnaces has had no further reduction this week, the reduced gait as compared with several weeks ago is having some effect on employment. Some of the men in open-hearth departments who formerly worked five and a half days a week are now working four.

Pig iron output has not been cut down, but many of the foundries in this district are down to four or five days a week.

Steel companies are relying on the automobile industry to give steel business somewhat of a lift in the next few weeks.

Walsh Construction Co. of Syracuse is low general bidder on the Belle Isle, N. Y., grade crossing elimination job for the New York Central. Bids will be taken Oct. 14 for a grade crossing job over the Erie and B. & S. railroads at Kennedy, N. Y., to require 153 tons of fabricated structural.

In the reinforcing bar field about the only offerings are a few road jobs of small tonnage.

New Ford Furnace 1200 Tons Capacity

THE new blast furnace to be built by the Ford Motor Co. as part of its River Rouge plant expansion program, will be lined to 25 ft. 6 in. hearth, 29 ft. bosh, 16-ft. bell and 20-ft. stock line. The furnace will be designed for the substitution of lighter linings that will give it ultimate dimensions of 27 ft. 9 in. hearth, 31 ft. 3 in. bosh, 17 ft. 3 in. bell and 22 ft. 3 in. stock line. The height of the stack will be 102 ft. The initial volume will be 43,445 cu. ft. and the ultimate volume 51,445 ft. The volume is believed to be larger than in any blast furnace previously constructed. The stack will have a daily capacity of 1200 tons or more.

Arthur G. McKee & Co., Cleveland, have the contract for both designing and constructing the furnace. Its erection, requiring a year, probably will be started in about 60 days.

September Machine Tool Orders Climb

MACHINE tool sales in September increased to an index number of 210.7 as compared with 179.8 for August, according to the monthly report of the National Machine Tool Builders Association.

Foreign orders rose sharply to an index number of 91.7 from 50.3 the previous month and domestic orders declined to an index number of 119 as against 129.5 for August. However, domestic orders were 3.6 points larger than in July. The three-month average advanced to 187.2 in September from 180.9 in August.

. . . Awards of 8025 tons —5110 tons in new projects.

AWARDS

New York, 500 tons, Beadleston & Woerz warehouse, to Truscon Steel Co., Youngstown.

Queens, N. Y., 1800 tons, sewer, to Truscon Steel Co., Youngstown.

Laurelton, Pa., 150 tons, cottages, Laurelton State Village, to Bethlehem Steel Co.

Laurelton, 180 tons, State building, to Milton Mfg. Co.

Roanoke, Va., 100 tons, hotel addition, to Knoxville Iron Co., Knoxville, Tenn.

Detroit, 3200 tons, Baby Creek sewer, section No. 3, S. A. Healy, contractor, to Carnegie-Illinois Steel Corp.

Marysville, Mich., 100 tons, water filtration plant, to Bethlehem Steel Co.

Bloomington, Ill., 120 tons, Auto-Hotel, to Laclede Steel Co., St. Louis.

Waukesha, Wis., 115 tons, court house addition, to W. H. Pipkorn Co., Milwaukee.

LaCrosse, Wis., 175 tons, Allis-Chalmers Mfg. Co., to Ceco Steel Products, Omaha, Neb.

St. Louis, 625 tons, psychopathic hospital, to Laclede Steel Co., St. Louis.

Minneapolis, 160 tons, University of Minnesota forestry building, to Bethlehem Steel Co.

Soledad, Cal., 800 tons, State highway bridge, to Soule Steel Co.

NEW REINFORCING BAR PROJECTS

New York, 306 tons, grading and paving, Henry Hudson Parkway.

State of New Jersey, 570 tons, highway project, Elizabeth and Troy.

Netcong, N. J., 100 tons, 50 tons mesh and 50 tons of bars, highway project.

Selinsgrove, Pa., 300 tons; bids opened.

Louisville, Ky., 275 tons, Stewart Dairy Goods Co.

Cincinnati, 200 tons, paving deck and approaches, Eggleston Avenue viaduct.

Sandusky, Ohio, 385 tons, retaining wall for Pennsylvania Railroad; bids Oct. 25.

Chicago, 350 tons, Roosevelt Road project.

St. Louis, 200 tons, women's building for Masonic Home; Koerner Engineering Co., St. Louis, engineer. Bids due Oct. 26.

St. Louis, tonnage not determined, six-story addition and eight-story and basement building for Ralston Purina Co.; Mauran, Russell, Crowell & Mullgardt, architects; W. J. Knight, St. Louis, engineer. Bids due Oct. 20.

Denver, 1900 tons, deformed bars for Bureau of Reclamation; bids Oct. 18.

Denver, 125 tons, State highway construction; bids opened.

Sutter County, Cal., 700 tons, bridge across Sutter by-pass; bids Oct. 27.

. . . CLEVELAND . . .

. . . Production increased in Cleveland plant; two open hearths started.

* * *

. . . Steel shipments exceeding new orders by about 15 per cent.

* * *

. . . Steel mills taking strong stand against concessions in prices.

CLEVELAND, Oct. 12.—The starting up of two additional open-hearth furnaces in a local steel plant caused a four point advance to 69 per cent this week in ingot output in the Cleveland-Lorain district. The rate in the Youngstown district is unchanged at 60 per cent of capacity.

A slight gain in business in finished steel during the past week is reported by some of the mills. However, not much new sheet tonnage came out as there were no large orders from motor car manufacturers as during the previous week. The improvement was mostly in bars, strip steel and structural shapes.

Steel shipments still exceed incoming business, being about 15 per cent larger in the case of some producers, and backlogs have been so nearly wiped out that some of the mills are depending on orders that come in from day to day to maintain their operating schedules.

A favorable factor is an improvement in export business in many steel products.

New buying that has been retarded for some time by consumers' large inventories is now facing another obstacle, that is a hesitancy that has appeared among some consumers because of rumors of price cutting. That these rumors are baseless is indicated by the strong stand that is being taken by the steel industry against any price concession. No pressure, it is said, has come from large consumers in the automotive and other fields for lower prices and some consumers have expressed strong opposition to any weakening of the price structure.

Many miscellaneous consumers of steel still have good stocks and those who are making purchases are buying only for their immediate needs. Some sheet consumers who overbought in the spring are still holding up shipments.

Iron ore shipments are declining rather rapidly, and there is no longer any expectation of a record-breaking movement this year.

Iron Ore

Expectations of a water movement breaking the 1929 record of 65,195,593 tons have gone glimmering with the cutting down of shipping schedules and the taking of a number of boats out of commission that has resulted from the slowing down of the steel industry. October will show quite a drastic cut in the movement. Present estimates are that shipments during the season will be from 62,000,000 to 63,000,000 tons. Shipments of cargoes by some outside boats chartered for ore by steel companies have been held up until next spring.

Pig Iron

Shipments so far this month show some gain over the same period in September, but producers doubt whether this increase will be maintained through the month. Heavier shipments to motor car foundries are being offset by decreased demand from some other consumers. Foundry coke shipments have improved over last month. Pig iron sales are very light. Many foundries still have good stocks and present buying is of a hand-to-mouth character, as consumers as a rule are buying only for immediate needs.

Sheets and Strip

Buying of considerable tonnage of sheets by two leading motor car manufacturers reported last week has been followed by another lull in the demand from that source and the volume of new business was quite light the past week. Little tonnage is coming from stamping plants making automobile parts in this territory, as they are not securing sizable releases. Little business is coming from makers of household equipment and various miscellaneous consumers. Many users still have good stocks, in some cases enough to last them to near the end of the year and some who overbought quite heavily in the spring are holding up shipments. Strip experienced a little pick-up the past week, some orders for small lots coming from automobile parts plants.

Bolts and Nuts

The volume of business shows some gain over September, which is largely due to fair releases that are now coming from the motor car industry. Demand from jobbers continues light and orders from railroads are scarce.

Bars, Plates and Shapes

New demand for merchant bars shows some improvement, due mostly to fresh orders from forge shops that have secured releases from motor car plants. Demand from agricultural implement manufacturers continues good. Structural shapes that have been inactive for several weeks also show a little improvement. A moderate volume of private building work is coming out requiring small lots of structural shapes but no large projects either private or public are pending. Pennsylvania Railroad will take bids Oct. 25 for a retaining wall at its Sandusky dock requiring 385 tons of reinforcing bars. Plates are very quiet.

. . BIRMINGHAM . .

. . . Fall business disappointing; operations are reduced.

BIRMINGHAM, Oct. 12.—Cotton ties and drum stock sheets are the most active items in the Birmingham steel market at pres-

ent. Roofing sheets have not yet shown the usual fall pick-up, and the same is also true of wire products. Fall business has been disappointing but some improvement is hoped for before the end of the month. There is a heavy tonnage of structural steel backlogs still on hand, but these are awaiting releases which have not yet developed.

For two weeks open hearth operations have had successive reductions. Last week 14 units were operated, as compared with 17 the preceding week. This week 14 are also scheduled. Six will be operated at Fairfield, three at Ensley and five at Gadsden.

As a majority of regular customers have already placed tonnage for the fourth quarter, buying of pig iron is rather limited. Current business now consists mostly of small spot orders from foundries. Shipments are at a satisfactory rate. Furnace operations remain at 17, with one stack out for relining.

. . . *Outlook is considered encouraging for steel.*

TORONTO, Oct. 12.—A lull resulting from the Ontario provincial election was overcome with a return of the Hepburn Government to power. New interest is developing in the mining fields which is expected to result in more extensive buying in this quarter in the not distant future. Industrial operations are believed to be nearing their peak for the year unless there is an early repetition of large railroad orders, which are expected but so far are not actually in sight.

New orders are appearing for steel and manufactured products from Great Britain, and extensive shipments are being made at regular interyals. Officials of Dominion Steel & Coal Corp., Sydney, N. S., report increased shipments of iron ore this year from the Wabana mines in Newfoundland to Great Britain and other European countries.

Demand for agricultural implements continues at a high level both for domestic use and export. The Massey-Harris Co. will reopen its Woodstock, Ont., plant which has been closed for eight years.

General outlook for steel markets is bright and practically all Canadian companies are reporting production and earnings well in excess of those of any year since 1929. Steel prices are holding at a steady level.

Demand for merchant pig iron shows minor improvement.

New developments are absent in the iron and steel scrap markets. Steel mills have been obtaining supplies from the railroads which to some extent has relieved pressure on dealers for heavy melting steel and turnings. Mills are taking practically all the scrap offered by the railroads. Foundries are in the market for machinery cast, cast and stove plate, and dealers state that they have a market for all these materials they can obtain.

. . . *Undigested inventories check buying of steel.*

ST. LOUIS, Oct. 12.—The demand for finished steel is unusually light. "Undigested inventories," due to heavy buying earlier in the year and a recent falling of the file of backlog orders, an uneasiness caused by the situation in Wall Street, and the feeling that prices for the first quarter of 1938 will not advance are some of the reasons advanced for the small amount of business being placed. Warehouse business for September was about on a par with August, and buying so far in October is equal to September.

Bids are due Oct. 20 for a six-story addition and a new eight-story building for Ralston Purina Co., 70 x 200 ft. overall. Bids are due Oct. 26 for a woman's building at the Masonic Home here, requiring 200 tons of reinforcing bars and 100 tons of structural shapes. Bids have been rejected by the Kansas City (Mo.) Terminal Railway for a bridge over Blue River, requiring 550 tons of structural shapes, and new bids will be asked.

Shipments of pig iron are small, and sales are confined to spot cars for immediate needs. The melt is off in the steel mills, in the jobbing foundries and in the stove plants in the district, although there is no let-up in the production of agricultural implements.

Open hearth ingot production is down to 57 per cent of capacity.

. . . *Bids to be taken on Government projects.*

SAN FRANCISCO, Oct. 11.—Bids on two steel projects will be opened on Oct. 18. The general purchasing officer at Panama Canal, C. Z., will receive until that date bids on 1600 tons of structural steel to be used in various construction projects. The Bureau of Reclamation office at Denver will take bids on 1900 tons of deformed reinforcing bars to be used in reclamation projects throughout the West.

Bids will be opened Oct. 27 on 700 tons of reinforcing bars for the construction of a reinforced concrete slab bridge across Sutter By-Pass, 12 miles west of Yuba City, Cal. Belmont Iron Works is low bidder on 800 tons of structural steel called for in the building of a hangar for Sandpoint airport, Seattle, Wash.

The only award of importance last week was that of 800 tons of reinforcing bars for a State highway bridge near Soledad, Cal., to Soule Steel Co. This award has been pending for several weeks.

Activity in the steel market has increased somewhat and in the cast iron pipe market considerably. Several important cast iron pipe tonnages will be contracted in the Pacific Northwest within the next two months. No definite information is yet available on this work.

Metropolitan Water District, Los Angeles, opens bids Nov. 8 on 1200 tons of H sections or 1150 tons of pipe for posts, also 1180 tons of fence fabric and 150 tons of barbed and plain wire for use in construction of woven wire fences and gates at certain reservoirs of the Colorado River aqueduct.

Roosevelt Calls Special Session

WASHINGTON, Oct. 12.—President Roosevelt today issued a proclamation calling a special session of Congress beginning Nov. 15, "Because the public interest requires it." Legislation in contemplation relates to wages and hours, agricultural production control, regional set-up of TVA and Government reorganization.

. . . . NEW YORK. . . .

. . . New business making small, spotty gains.

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. . . Prices firm as some buyers try for concessions.

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. . . Export demand increases, but differences on prices exist.

NEW YORK, Oct. 12.—Here and there some spotty improvement in steel orders has occurred, but hardly enough to constitute a new trend. While the trade has virtually abandoned hope of a pronounced upward swing over the remainder of the year, it is believed that a gain over the present low volume is in order. Steel buyers are still extremely cautious, but it is likely that now they are reducing stocks even though the demands upon them are not as large as a few months ago. It is generally expected that hand-to-mouth buying will prevail until after the year-end inventory period.

Except for some weakness in resale prices on pipe, galvanized sheets and reinforcing bars, which are not new developments, the price situation remains firm. Steel mills have been approached by buyers for concessions, but have taken a strong stand against any reductions. The general feeling among steel people is that present high wages and other high costs will act as a deterrent on price cutting. There has been no evidence of any shading.

A situation that prevails in Texas on plates has been cited as price weakness, but the facts indicate merely an adjustment of delivered prices by Eastern mills to meet the delivered prices of mills in the Central districts. Eastern mills, shipping by rail and water, formerly had a slight advantage in Texas, but an advance in ocean rates and in some local rail tariffs in Texas have wiped out this advantage, so that the all-rail delivered price from Pittsburgh or Chicago is lower than the price from the East, figured on a Coatesville base. It is understood that some of the Eastern mills have met the situation, which apparently does not differ from the common practice of equalizing freight rates with competitive mills.

Export inquiry and sales are becoming a more important factor. British and Continental buyers have come into the market to a greater extent than heretofore, but only a small part of the business under negotiation has been closed because of differences as to prices. On semi-finished steel British buyers are trying to obtain quotations delivered in Britain equivalent to our domestic prices, which means that American shippers would have to absorb freight charges and other transportation costs. Some concessions have been made, but probably not of the full amount British buyers have been trying to obtain.

Approximately 60,000 tons of structural shapes and liner plates will be required in the proposed mid-town Manhattan underpass, now before the Board of Estimate for approval. The underpass will connect the Lincoln Tunnel with the East River Tunnel.

Plates and Sheets

New plate business is still very scarce and orders coming in during the past two weeks have represented the lowest level of the year. All plate users are relatively inactive in buying, with the possible exception of fabricators of domestic tanks for oil storage. With building activity slowing up materially, boiler makers find themselves with ample stocks of plate on hand in the face of a falling market for their finished product. In the smaller sizes, inventories of finished boilers are large, boilers that were fabricated last spring when material and labor costs were lower.

Foreign inquiry on plates is increasing, particularly from the Orient, and some business is being booked on a strictly cash basis. A small tonnage has been taken at below the domestic price.

Sheet specialties, including stainless, are more active than the regular grades. Warehouse business continues light in the presence of large stocks. A carload lot sale of galvanized sheets via jobber for shipment direct to consumer is reported on the new basis whereby the usual jobbers' functional allowance is eliminated.

Pig Iron

Slowly increasing shipments have given rise to an optimistic attitude in the market that has not as yet been substantiated by the amount of new business being placed. Part of this attitude may be attributed to the fact that unshipped tonnages on orders placed during the buying wave this spring are fast diminishing, and, in view of the present rate of consumption, buying activity has apparently been delayed only pending a firmer stock market and a definite knowledge of the Administration's foreign policy. The house heater foundries and the heavy machine parts plants are chiefly responsible for the increase in shipments; some heater shops are casting on a six-day basis. Export interest is at low ebb, and, although several large inquiries are still out, very few orders of any consequence are being placed at present. However there has been a number of orders placed for small lots, ranging from 25 to 150 tons. These orders call for unusual analyses and are for shipment to Central Europe.

. . . BOSTON. . .

. . . Pig iron demand slow; export sales checked by price differences.

BOSTON, Oct. 11.—Furnace representatives agree demand for pig iron for domestic consumption never was quieter than it is today. Further, there is nothing at the moment that suggests a change for the better. The largest New England consumers many months ago bought sufficient iron to carry them through 1937, and since last Labor Day cancellations of orders for castings and a constant dwindling in new business have brought the weekly melt down to the lowest level of the year. Six months ago there was a shortage of molders. Today, with layoffs, there is no shortage.

A difference of opinion regarding prices among furnaces and prospects has put a check on the export market. It is said by furnace interests that very large tonnages of iron could be sold to England if buyers and sellers could come to an agreement, but that England's idea of prices is far out of line with current quotations.

. . PHILADELPHIA . .

. . . District operation drops six points to 54 per cent.

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. . . Consumers work off stocks; buying at a low ebb.

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. . . Outlook uncertain, but not totally discouraging.

PHILADELPHIA, Oct. 12. — Faced with very lean order books and a moderate supply of stocked ingots, practically every mill in this territory has taken off one or more open hearths this week. Consequently, the aggregate operating rate for eastern Pennsylvania is down six points to 54 per cent of theoretical capacity. As a comparison, it is necessary to go back to early September, 1936, to find a period in which the district's activity was at a lower figure than it is today.

Orders currently coming onto mill books are still not in sufficient volume to maintain operations even at the current figure. Some sellers report a good volume of miscellaneous business, but it is obvious that the district badly needs action on the part of the large consumers, particularly the railroads and the shipyards, and even the building industry. For the latter, not much is expected of it over the remainder of the year, but prospects for buying on the part of carriers and ship makers are not entirely negative. This district continues to believe that the railroad rate question will be settled shortly and will be followed by steel orders, and there is also a belief, tempered considerably by hope, that Government-subsidized shipbuilding will shortly swing into action.

With all producers actively searching for business, the price structure is holding remarkably firm. There has been a sagging in prices for reinforcing, fabricated structural steel and pipe on the part of secondary sellers, but these items were none too steady when steel business generally was booming. Major products, such as sheets, strip, plate and wire products show no signs of weakness whatsoever. In fact, consumers are pressing for no reduction, inasmuch as many of them still have stocks on hand and have no desire to mark off losses on their inventory in the advent of mill price reductions.

Scrap prices continue to drop off as mill sentiment remains bearish. Price reductions this week vary from 50c. to $2.50.

Pig Iron

Each day it is more obvious that furnaces have had better backlogs than was generally realized a month ago. Over the past month or six weeks, little or no new business has come into the market, and even today inquiry is spotty and only for small lots. However, a sizable volume of deliveries continues to go forward on old orders, and there has yet been no stock accumulation of any moment at any district stack. No furnace in this area has yet gone out for repairs, but several are in poor condition and may be blown out momentarily, or may last for several months yet. Several cargoes of iron left here for foreign consumption during the week, all of it on old orders. Export backlog in this district is almost liquidated—some replacement ordering is expected, but on the whole the currently heavy volume of foreign inquiry is failing to crystallize into actual orders.

Sheets and Strip

Many of the principal consumers continue to work off their stocks and are not expected back into the market for at least several weeks. Warehouse turnover is down from 30 to 40 per cent, the cause being that mills are now able to handle small orders with little or no delay in delivery. Philadelphia's two autobody stamping plants are now very active, and are consuming and buying sizable quantities of steel each week. Even better operations are expected by the month's end. Prices on all types of sheets and strip have shown not the slightest sign of faltering.

Plates and Shapes

A scattered miscellaneous demand for plates is drifting into the mills, but the aggregate quantity involved is far from encouraging, nor is the immediate outlook one which calls for much enthusiasm. Mill prices on plain shapes are very steady, but fabricators are figuring very close to the line in their search for the little business that is coming up for consideration. There was no award of shapes of any size during the week, and the only new projects are a 150-ton addition for the Reyburn Mfg. Co., a 150-ton bridge at Mantoloking, N. J., and a 250-ton hospital at Fairview, Pa. Within the next two weeks, awards will be coming through for a 500-ton hospital at Selinsgrove, Pa., and 5000 tons for the Finance Building at Harrisburg. The Selinsgrove hospital will also take 300 tons of reinforcing bars. About 180 tons of rerolled bars has been awarded to Milton Mfg. Co. for a State building at Laurelton, Pa.

Imports

The following iron and steel imports were received here during the past week: 35 tons of wire rods, 58 tons of steel bars, 54 tons of steel tubes, and 15 tons of steel billets from Sweden; 3651 tons of chrome ore from South Africa; 499 tons of chrome ore and 498 tons of pig iron from British India.

Japan's Export Ban In Effect Shortly

THE Japan press has announced the draft of an ordinance by the Ministry of Commerce, expected to be enforced this month, restricting or prohibiting entirely exportation of a long list of commodities. Iron and steel products are expected to be unaffected.

This ordinance, empowering the Japanese government to order temporary emergency measures with regard to imports and exports, restricts by license imports of raw cotton and lumber, the two principal products interesting to the United States on the list.

Combined value of Japanese imports from the United States of the products which are to be prohibited importation is estimated at about $2,000,000 in 1935, or less than 1 per cent of the total value of Japan's imports from the United States.

. . . NON-FERROUS . . .

. . . *Domestic copper demands light.*

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. . . *Zinc stocks rise 2290 tons.*

o o o

. . . *Tin prices decline to 54c., New York.*

NEW YORK, Oct. 11.—Although quotations on domestic copper dropped during the week to a low that has been equaled this year only during the first week of January, sales have been very light, totaling only 6812 tons for the month to date. The generally disturbing political situation both here and abroad is credited with being the cause of the lack of interest in the current level of 12c. per lb., Connecticut Valley, for the electrolytic grade. Mine producers are still maintaining the 13c. level and there has been a noticeable tapering in offerings of 12c. metal. This, together with the fact that sales to company-affiliated fabricators, accounting for the bulk of the current activity, are still made on the 13c. basis, suggests that a return to the 13c. level by the one smelter now quoting 12c. is quite probable. Buying in London has been very moderate, with prices rising and falling with each session of the Exchange. Export metal is quoted today at 11.95c., c.i.f., usual European base ports.

The Week's Prices. Cents Per Pound for Early Delivery

	Oct. 6	Oct. 7	Oct. 8	Oct. 9	Oct. 11
Electrolytic copper, Conn.*	12.00	12.00	12.00	12.00	12.00
Lake copper, N. Y.	13.125	13.125	13.125	13.125	13.125
Straits tin spot, New York	54.375	54.625	54.625	....	54.00
Zinc, East St. Louis	6.25	6.25	6.25	6.25	6.25
Zinc, New York	6.60	6.60	6.60	6.60	6.60
Lead, St. Louis	5.85	5.85	5.85	5.85	5.85
Lead, New York	6.00	6.00	6.00	6.00	6.00

*Delivered Connecticut Valley; price ¼c. lower delivered in New York.
Aluminum, virgin, 99 per cent plus 20.00c.-21.00c. a lb., delivered.
Aluminum No. 12 remelt No. 2 standard, in carloads, 19.00c. to 19.50c. a lb., delivered.
Nickel, electrolytic, 35c. to 36c. a lb. base refinery, in lots of 2 tons or more.
Antimony, Asiatic, 18.50c. a lb., prompt, f.o.b., New York.
Antimony, American, 16.50c. per lb., prompt shipment, New York.
Quicksilver, $89.00 per flask of 76 lb.
Brass ingots, commercial 85-5-5-5, 13.25c. a lb., less carload, delivered; in Middle West ¼c. a lb. is added on orders for less than 40,000 lb.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	55.50c. to 56.50c.
Tin, bar	57.50c. to 58.50c.
Copper, Lake	14.00c. to 15.00c.
Copper, electrolytic	14.00c. to 15.00c.
Copper, castings	13.75c. to 14.75c.
*Copper sheets, hot-rolled	21.125c.
*High brass sheets	19.25c.
*Seamless brass tubes	22.00c.
*Seamless copper tubes	21.875c.
*Brass rods	15.75c.
Zinc, slabs	8.75c. to 9.75c.
Zinc, sheets (No. 9), casks, 1200 lb. and over	13.00c.
Lead, American pig	7.00c. to 8.00c.
Lead, bar	8.00c. to 9.00c.
Lead, sheets, cut	10.00c.
Antimony, Asiatic	19.50c.
Alum., virgin, 99 per cent plus	22.50c. to 24.00c.
Alum., No. 1 for remelting, 98 to 99 per cent	19.50c. to 21.00c.
Solder, ½ and ½	34.00c. to 35.00c.
Babbitt metal, commercial grade	25.00c. to 65.00c.

*These prices, which are also for delivery from Chicago and Cleveland warehouses, are quoted with 25 per cent allowed off for extras, except copper sheets and brass rods, on which allowance is 40 per cent.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	58.25c.
Tin, bar	60.25c.
Copper, Lake	14.00c. to 14.25c.
Copper, electrolytic	14.00c. to 14.25c.
Copper, castings	13.75c. to 14.00c.
Zinc, slabs	8.75c. to 9.00c.
Lead, American pig	6.50c. to 6.75c.
Lead, bar	10.00c. to 10.50c.
Antimony, Asiatic	19.25c.
Babbitt metal, medium grade	23.50c.
Babbitt metal, high grade	62.25c.
Solder, ½ and ½	38.00c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	8.875c.	9.625c.
Copper, hvy. and wire	8.25c.	8.75c.
Copper, light and bottoms	7.25c.	7.50c.
Brass, heavy	4.625c.	5.25c.
Brass, light	4.00c.	4.75c.
Hvy. machine composition	7.50c.	8.00c.
No. 1 yel. brass turnings	5.75c.	6.25c.
No. 1 red brass or compos. turnings	7.25c.	7.75c.
Lead, heavy	4.50c.	4.875c.
Cast aluminum	11.125c.	12.25c.
Sheet aluminum	13.25c.	14.75c.
Zinc	3.50c.	3.875c.

Zinc

Statistics on slab zinc for September showed an advance in stocks of 2290 tons to 13,517 tons, the first increase of any size since June, 1936. A month ago stocks stood at 11,227 tons; a year ago at 76,482 tons. Shipments for the month declined to 47,737 tons from 50,643 tons in August. Unfilled orders also declined and stood at 92,319 tons at the end of the month, as compared with 106,187 tons a month ago. Prime Western quotations on Wednesday were lowered to 6.60c. per lb., New York, and although deliveries of spelter continue unabated, new business is very light.

Lead

The market has been moderately active all week with quotations holding firmly at 6c. per lb., New York. Buying has centered chiefly on October requirements which are about 65 per cent covered. The weakness of the non-ferrous market three weeks ago has inspired extreme caution on the part of buyers, as far as future commitments are concerned. However, the consumption of lead is continuing without letdown and it is estimated that deliveries in September will be around 55,000 tons. Stocks will probably drop below the 100,000 ton level. The London market has been fairly steady and quotations today on prompt metal ranges between 4.01c. and 4.03c. per lb.

Tin

Quotations dropped steadily during the week from a high of 54.625c. on Thursday to 54c. per lb., New York, for Straits metal today. On each decline there has been a fair amount of buying, but the weakness of the stock market here and the softness of prices in London has engendered hesitancy on the part of buyers in making forward commitments, and, despite the lowest prices that have prevailed in some time, there is no real interest in the market at present. Straits metal for prompt delivery was quoted at £230 10s. this morning in London. Futures were available at £229 5s. A week ago the respective quotations were £242 10s and £241 5s.

IRON AND STEEL SCRAP

. . . Market weakens further as mill buying continues inactive.

OCT. 12.—Further weakness has developed in all markets as mills continue to remain out of the market and hold up shipments on old orders. No. 1 steel finds no takers at Pittsburgh at $17.50 a ton, where the top price is marked down to this figure in the presence of such inaction. No. 1 steel is off $1 at Chicago, where a fairly substantial tonnage was sold at $15 delivered. With a decline of 50c. at Philadelphia, THE IRON AGE'S composite price of the No. 1 melting grade is down 66c. to $16.25, new low for the year and $5.67 below the high of $21.92 scored on March 30. The present figure is close to that prevailing in early December, 1936. Most definite transactions of the week were the sales of railroad heavy melting steel, which brought $17.50 at Buffalo, Cleveland and Pittsburgh. Other railroad lists brought as high as $18.50, delivered Pittsburgh. Reflecting the present lack of ocean bottoms, export buying prices have declined.

Pittsburgh

The scrap market continues in a state of lethargy with practically no buying or selling because of embargoes on shipments to steel mills. One or two dealers have offered moderate tonnages of No. 1 heavy melting at $17.50 a ton with no takers. On the basis of these offers, No. 1 heavy melting steel is quoted this week at $17 to $17.50, off 50c. a ton from last week's price. Action on two railroad lists during the past week discloses further irregularity in the scrap market. The Pittsburgh & Lake Erie list involving a moderate tonnage went to a broker at $17.50 a ton. It is understood that the railroad heavy melting on the Pennsylvania list was sold in a range of from $17.60 to $18.50 a ton, with the larger part going at the latter figure.

Chicago

Quotations of steel making grades, including heavy melting steel, and many other items have been reduced $1 a ton this week, as the result of lower brokers' bids and an actual sale of a substantial tonnage of No. 1 steel at $15 delivered. Brokers believe that this sale may mark the low point of the present decline, but with operations still on the downward path, bids may be seen at even lower levels. Material is being received in fair volume, neither too much nor too little.

Cleveland

Interest locally has centered in the price paid the New York Central Railroad for scrap it offered last week. This road's No. 1 heavy melting steel brought $17.50, Cleveland and Buffalo, which seems to be about in line with present quotations. The same grade offered by other railroads and absorbed in other districts is reported to have brought somewhat higher prices. The market remains inactive and an embargo against shipments is still in effect by leading Youngstown consumers. Cleveland prices are unchanged. Quotations are off 50c. a ton on heavy melting steel and bundles in Youngstown.

Buffalo

The market is dragging along with no new buying and all prices nominal. Releases on suspended orders by the largest consumer of the area, are expected by the end of this week. Railroad lists out recently are estimated to have brought the equivalent of $17.50, Buffalo.

Boston

Export heavy melting steel prices have shrunk another 25c. a ton, the weakness being based on a lack of buying rather than any pressure of material on the market. Exporters have plenty of business on their books but lack vessel space. However, they expect the scarcity of space will be relieved within a fortnight or three weeks. In that event, prices are expected to stiffen. For domestic consumption, business centers almost exclusively in bundled skeleton. Against old orders, brokers offer $9.75 a ton on cars for such material, and against new, $9.45. Foundry buying of textile and machinery cast has come almost to a standstill.

New York

The local market is practically demoralized and at a standstill as far as domestic sales are concerned. Prices are largely nominal therefore, but are marked down as a reflection of the complete lack of mill interest as material is offered at new low figures. Export material continues to show weakness also, largely because the European scrap cartel is not furnishing ocean bottoms in the numbers expected. Dealer offers are down 50c. to $1. Little significance is attached to the loading of two Hamburg-American passenger liners with 5000 tons of scrap each last week. As the summer tourist trade lessens, the ships were returning light and were actually seeking some load as ballast. Freight rates are no higher than on tramp steamers and are sometimes less. The Japanese have placed no new orders for scrap in more than three months.

Cincinnati

Chronic softness is still the condition of the local old materials market. Dealer activity is confined chiefly to covering old commitments with occasional small lot orders with no market significance. Bids have declined another 50c. on all items except borings and clippings.

St. Louis

The scrap iron market continues its downward march, declines ranging from 50c. to $2 a ton. The steel mills in the St. Louis area are not buying, having fairly large stocks of raw material and a dwindling backlog of orders. Dealers are covered on all their back orders, and have put off buying until the mills buy.

Detroit

The beginning of a movement to lay down scrap at present price-levels has been noted recently which, although not strong, is considered significant. If this materializes, the market should show considerable stiffening. As it is, it has been found nearly impossible in some cases to get quotations. A slight movement of hydraulic compressed sheets was reported during the week, although principal consumers on all grades have remained out of the market. Black fender stock, a No. 2 busheling item which had drawn a premium, is no longer being sought by consumers and is at least for the time being, not considered movable item in the Detroit market.

Philadelphia

The prevailing bearish sentiment among steel makers continues to depress the scrap market. Little or no new purchasing has developed on which to base quotations, but the undercurrent of sentiment alone insists that No. 1 steel be marked down to $16.50 to $17, with No. 2 steel ranging between $14.50 and $15. Foundries are taking some truck shipments of cast material directly from yards, but this type of demand is on the whole spotty and in poor volume, which condition forces a price reduction of from 50c. to $1 for cast grades. Steel axles have been sold recently at $24.50, and a parcel of shafting has been placed at $1 less. Otherwise the entire market is hesitant and undoubtedly verging on additional declines. Scrap yards here have settled their labor difficulties, with wages marked up substantially all along the line.

Iron and Steel Scrap Prices

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$17.00 to $17.50
Railroad hvy. mltng.	17.50 to 18.50
No. 2 hvy. mltng. stel.	15.00 to 15.50
No. 2 RR. wrought	17.00 to 17.50
Scrap rails	18.00 to 18.50
Rails 3 ft. and under	22.00 to 22.50
Comp. sheet steel	17.00 to 17.50
Hand bundled sheets	16.00 to 16.50
Hvy. steel axle turn.	15.50 to 16.00
Machine shop turn	12.00 to 12.50
Short shov. turn	13.00 to 13.50
Mixed bor. & turn.	13.50 to 14.00
Cast iron borings	13.50 to 14.00
Cast iron carwheels	18.50 to 19.00
Hvy. breakable cast.	14.50 to 15.00
No. 1 cupola cast	18.50 to 19.00
RR. knuckles & cplrs.	22.00 to 22.50
Rail coil & leaf springs	22.00 to 22.50
Rolled steel wheels	22.00 to 22.50
Low phos. billet crops.	22.00 to 22.50
Low phos. sh. bar	21.50 to 22.00
Low phos. punchings	19.50 to 20.00
Low phos. plate, hvy.	20.00 to 21.00
Low phos. plate clips	19.00 to 19.50
Steel car axles	22.50 to 23.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$16.50 to $17.00
No. 2 hvy. mltng. steel	14.50 to 15.00
Hydraulic bund., new	16.50 to 17.00
Hydraulic bund., old	13.00 to 13.50
Steel rails for rolling	20.50 to 21.00
Cast iron carwheels	19.00 to 19.50
Hvy. breakable cast.	17.00 to 17.50
No. 1 cast	19.00 to 19.50
Stove plate (steel wks.)	15.00 to 15.50
Railroad malleable	19.00 to 20.00
Machine shop turn.	13.00 to 13.50
No. 1 blast furnace	11.50 to 12.00
Cast borings	12.00 to 12.50
Heavy axle turnings	14.50 to 15.00
No. 1 low phos. hvy.	23.50 to 24.00
Couplers & knuckles	23.50 to 24.00
Rolled steel wheels	23.50 to 24.00
Steel axles	24.50 to 25.00
Shafting	23.00 to 23.50
No. 1 RR. wrought	19.50 to 20.00
Spec. iron & steel pipe	16.00 to 16.50
No. 1 forge fire	16.00 to 16.50
Cast borings (chem.)	14.50 to 15.00

CHICAGO

Delivered to Chicago district consumers:

	Per Gross Ton
Hvy. mltng. steel	$14.50 to $15.00
Auto. hvy. mltng. steel, alloy free	13.00 to 13.50
No. 3 auto. steel	11.00 to 12.00
Shoveling steel	14.50 to 15.00
Hydraul. comp. sheets	13.50 to 14.00
Drop forge flashings	11.50 to 12.00
No. 1 busheling	13.50 to 14.00
Rolled carwheels	18.75 to 19.25
Railroad tires, cut	18.25 to 18.75
Railroad leaf springs	18.25 to 18.75
Steel coup. & knuckles	18.75 to 19.25
Axle turnings	13.75 to 14.25
Coil springs	20.75 to 21.25
Axle turn. (elec.)	14.75 to 15.25
Low phos. punchings	18.25 to 18.75
Low phos. plates, 12 in. and under	18.75 to 19.25
Cast iron borings	9.75 to 10.25
Short shov. turnings	9.50 to 10.00
Machine shop turn.	7.50 to 8.00
Rerolling rails	17.00 to 17.50
Steel rails under 3 ft.	18.00 to 18.50
Steel rails under 2 ft.	18.50 to 19.00
Angle bars, steel	16.50 to 17.00
Cast iron carwheels	17.00 to 17.50
Railroad malleable	15.75 to 16.25
Agric. malleable	13.25 to 13.75
	Per Net Ton
Iron car axles	$21.50 to $22.00
Steel car axles	21.50 to 22.00
No. 1 RR. wrought	12.50 to 13.00
No. 2 RR. wrought	12.75 to 13.25
No. 2 busheling, old	6.25 to 6.75
Locomotive tires	16.25 to 16.75
Pipes and flues	10.75 to 11.25
No. 1 machinery cast	13.25 to 13.75
Clean auto. cast	13.25 to 13.75
No. 1 railroad cast	12.25 to 12.75
No. 1 agric. cast	11.75 to 12.25
Stove plate	10.25 to 10.75
Grate bars	10.75 to 11.25
Brake shoes	10.75 to 11.25

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$17.00 to $17.50
Hydraulic bundles	16.50 to 17.00
Machine shop turn.	13.50 to 14.00

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$17.00 to $17.50
No. 2 hvy. mltng. steel	16.00 to 16.50
Comp. sheet steel	16.50 to 17.00
Light bund. stampings	13.00 to 13.50
Drop forge flashings	16.00 to 16.50
Machine shop turn.	11.50 to 12.00
Short shov. turn.	12.50 to 13.00
No. 1 busheling	16.50 to 17.00
Steel axle turnings	14.00 to 14.50
Low phos. billet and bloom crops	23.00 to 23.50
Cast iron borings	12.50 to 13.00
Mixed bor. & turn.	12.50 to 13.00
No. 2 busheling	12.00 to 12.50
No. 1 cast	19.00 to 19.50
Railroad grate bars	11.50 to 12.00
Stove plate	11.00 to 11.50
Rails under 3 ft.	21.00 to 21.50
Rails for rolling	19.00 to 19.50
Railroad malleable	22.00 to 22.50
Cast iron carwheels	21.00

BUFFALO

Per gross ton, f.o.b. consumers' plants:

No. 1 hvy. mltng. steel	$17.00 to $17.50
No. 2 hvy. mltng. steel	15.00 to 15.50
Scrap rails	17.00 to 17.50
New hvy. b'ndled sheet	15.00 to 15.50
Old hydraul. bundles	14.00 to 14.50
Drop forge flashings	15.00 to 15.50
No. 1 busheling	15.00 to 15.50
Hvy. axle turnings	12.50 to 13.00
Machine shop turn.	11.00 to 11.50
Knuckles & couplers	19.50 to 20.00
Coil & leaf springs	19.50 to 20.00
Rolled steel wheels	19.50 to 20.00
Low phos. billet crops	20.00 to 20.50
Shov. turnings	12.00 to 12.50
Mixed bor. & turn.	10.50 to 11.00
Cast iron borings	11.00 to 11.50
Steel car axles	18.00 to 18.50
No. 1 machinery cast	17.00 to 17.50
No. 1 cupola cast	15.50 to 16.00
Stove plate	11.00 to 11.50
Steel rails under 3 ft.	20.00 to 20.50
Cast iron carwheels	14.50 to 15.00
Railroad malleable	18.00 to 18.50
Chemical borings	11.50 to 12.00

ST. LOUIS

Dealers' buying prices per gross ton delivered to consumer:

Selected hvy. melting	$16.00 to $16.50
No. 1 hvy. melting	15.50 to 16.00
No. 2 hvy. melting	14.00 to 14.50
No. 1 locomotive tires	18.00 to 18.50
Misc. stand.-sec. rails	17.00 to 17.50
Railroad springs	21.00 to 21.50
Bundled sheets	10.50 to 11.00
No. 1 busheling	11.50 to 12.00
Cast bor. & turn.	8.00 to 8.50
Rails for rollings	18.00 to 18.50
Machine shop turn.	8.00 to 8.50
Heavy turnings	12.00 to 12.50
Steel car axles	19.50 to 20.00
Iron car axles	21.50 to 22.00
No. 1 RR. wrought	12.00 to 12.50
No. 2 RR. wrought	15.50 to 16.00
Steel rails under 3 ft.	18.00 to 18.50
Steel angle bars	16.50 to 17.00
Cast iron carwheels	17.00 to 17.50
No. 1 machinery cast	13.25 to 13.75
Railroad malleable	15.00 to 15.50
No. 1 railroad cast	13.25 to 13.75
Stove plate	11.50 to 12.00
Agricul. malleable	12.50 to 13.00
Grate bars	11.50 to 12.00
Brake shoes	11.50 to 12.00

CINCINNATI

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel	$13.00 to $13.50
No. 2 hvy. mltng. steel	10.00 to 10.50
Scrap rails for mltng.	17.00 to 17.50
Loose sheet clippings	9.00 to 9.50
Hydrau. b'ndled sheets	13.00 to 13.50
Cast iron borings	7.00 to 7.50
Machine shop turn.	8.50 to 9.00
No. 1 busheling	11.00 to 11.50
No. 2 busheling	5.50 to 6.00
Rails for rolling	19.00 to 19.50
No. 1 locomotive tires	15.50 to 16.00
Short rails	19.50 to 20.00
Cast iron carwheels	14.00 to 14.50
No. 1 machinery cast	13.00 to 13.50
No. 1 railroad cast	11.50 to 12.00
Burnt cast	8.00 to 8.50
Stove plate	8.00 to 8.50
Agricult. malleable	13.00 to 13.50
Railroad malleable	15.00 to 15.50
Mixed hvy. cast	9.50 to 10.00

BIRMINGHAM

Per gross ton delivered to consumer:

Hvy. melting steel	$16.00 to $16.50
Scrap steel rails	17.00
Short shov. turnings	8.50
Stove plate	10.50
Steel axles	18.00 to 19.00
Iron axles	15.50 to 18.00
No. 1 RR. wrought	13.00 to 15.00
Rails for rolling	18.00 to 20.00
No. 1 cast	16.00 to 18.00
Tramcar wheels	16.00 to 18.00

DETROIT

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel	$13.00 to $13.50
No. 2 hvy. mltng. steel	12.00 to 12.50
Borings and turnings	9.25 to 9.75
Long turnings	9.00 to 9.50
Short shov. turnings	10.50 to 11.00
No. 1 machinery cast	14.00 to 14.50
Automotive cast.	15.00 to 15.50
Hvy. breakable cast.	12.50 to 13.00
Hydraul. comp. sheets	14.00 to 14.50
Stove plate	9.50 to 10.00
New factory bushel	13.00 to 13.50
Old No. 2 busheling	9.00 to 9.50
No. 2 busheling (black fender stock)	Nominal
Sheet clippings	10.75 to 11.25
Flashings	13.00 to 13.50
Low phos. plate scrap	15.00 to 15.50

NEW YORK

Dealers' buying prices per gross ton on cars:

No. 1 hvy. mltng. steel	$13.00 to $13.50
No. 2 hvy. mltng. steel	11.50 to 12.00
Hvy. breakable cast.	13.50 to 14.00
No. 1 machinery cast	15.00 to 15.50
No. 2 cast.	13.00 to 13.50
Stove plate	11.00 to 11.50
Steel car axles	25.00 to 25.50
Shafting	18.50 to 19.00
No. 1 RR. wrought	15.50 to 16.00
No. 1 wrought long	15.00 to 15.50
Spec. iron & steel pipe	13.00 to 13.50
Rails for rolling	17.50 to 18.00
Clean steel turnings	9.25 to 9.75
Cast borings	8.50 to 9.00
No. 1 blast furnace	8.00 to 8.50
Cast borings (chem.)	12.50 to 13.00
Unprepar. yard scrap	8.00 to 8.50

Per gross ton, delivered local foundries:

No. 1 machn. cast	$17.50 to $18.50
No. 1 hvy. cast cupola	14.50 to 15.00
No. 2 cast	14.00 to 14.50

BOSTON

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel	$14.80 to $15.30
Scrap rails	14.80 to 15.30
No. 2 steel	13.80 to 14.30
Breakable cast.	13.00 to 13.50
Machine shop turn.	7.45
Mixed bor. & turn.	7.45
Bund. skeleton long	9.75
Shafting	18.00 to 18.25
Cast bor. chemical	9.00 to 10.00

Per gross ton delivered consumers' yards:

Textile cast.	$18.00 to $19.00
No. 1 machine cast	18.00 to 19.00

PACIFIC COAST

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel	$14.00 to $15.00
No. 2 hvy. mltng. steel	11.50

CANADA

Dealers' buying prices at their yards, per gross ton:

	Toronto	Montreal
No. 1 hvy. mltng. stl.	$14.50	$14.00
No. 2 hvy. mltng. stl.	13.50	13.00
Mixed dealers steel	12.50	12.00
Scrap pipe	11.75	11.50
Steel turnings	9.75	9.50
Cast borings	11.00	10.50
Machinery cast	18.00	17.00
Dealers cast	16.00	15.00
Stove plate	13.00	11.00

EXPORT

Dealers' buying prices per gross ton:

New York, truck lots, delivered, barges.

No. 1 hvy. mltng. steel	$14.50 to $15.00
No. 2 hvy. mltng. steel	13.50 to 14.00
No. 2 cast.	12.50
Stove plate	10.50

Boston on cars at Army Base or Mystic Wharf

No. 1 hvy. mltng. steel	$15.75
No. 2 hvy. mltng. steel	14.75
Rails (scrap)	15.75

Philadelphia, delivered alongside boats, Port Richmond

No market at present.

PRICES ON FINISHED AND SEMI-FINISHED IRON AND STEEL

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham. Prices at Duluth are $2 a ton higher, and delivered Detroit $3 higher.

	Per Gross Ton
Rerolling	$37.00
Forging quality	42.00

Sheet Bars

F.o.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open-hearth or Bessemer	$37.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	2.10c.

Wire Rods
(No. 5 to 9/32 in.)

	Per Gross Ton
F.o.b. Pittsburgh or Cleveland	$47.00
F.o.b. Chicago, Youngstown or Anderson, Ind.	48.00
F.o.b. Worcester, Mass.	49.00
F.o.b. Birmingham	50.00
F.o.b. San Francisco	56.00
F.o.b. Galveston	53.00

Rods over 9/32 in. to 47/64 in., inclusive, $5 a ton over base.

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel

	Base per Lb.
F.o.b. Pittsburgh	2.45c.
F.o.b. Chicago or Gary	2.50c.
F.o.b. Duluth	2.60c.
Del'd Detroit	2.60c.
F.o.b. Cleveland	2.50c.
F.o.b. Buffalo	2.55c.
Del'd Philadelphia	2.74c.
Del'd New York	2.78c.
F.o.b. Birmingham	2.60c.
F.o.b. cars dock Gulf ports	2.85c.
F.o.b. cars Pacific Ports	3.00c.

Rail Steel
(For merchant trade)

F.o.b. Pittsburgh	2.30c.
F.o.b. Cleveland, Chicago, Gary or Moline, Ill.	2.35c.
F.o.b. Buffalo	2.40c.
F.o.b. Birmingham	2.45c.
F.o.b. cars dock Gulf ports	2.70c.
F.o.b. cars dock Pacific ports	2.85c.

Billet Steel Reinforcing
(Straight lengths as quoted by distributers)

F.o.b. Pittsburgh	2.55c.
F.o.b. Buffalo, Cleveland, Youngstown, Chicago, Gary or Birmingham	2.60c.
Del'd Detroit	2.70c.
F.o.b. cars dock Gulf ports	2.95c.
F.o.b. cars dock Pacific ports	2.95c.

Rail Steel Reinforcing
(Straight lengths as quoted by distributers)

F.o.b. Pittsburgh	2.40c.
F.o.b. Buffalo, Cleveland, Youngstown, Chicago, Gary or Birmingham	2.45c.
F.o.b. cars dock Gulf ports	2.80c.
F.o.b. cars dock Pacific ports	2.80c.

Iron

F.o.b. Chicago	2.40c.
F.o.b. Pittsburgh (refined)	3.60c.

Cold Finished Bars and Shafting*

	Base per Lb.
F.o.b. Pittsburgh	2.90c.
F.o.b. Cleveland, Chicago and Gary	2.95c.
F.o.b. Buffalo	3.00c.
F.o.b. Detroit	2.95c.

* In quantities of 10,000 to 19,999 lb.

Plates

	Base per Lb.
F.o.b. Pittsburgh	2.25c.
F.o.b. Chicago or Gary	2.30c.
Del'd Cleveland	2.435c.
F.o.b. Coatesville or Spar. Pt.	2.35c.
Del'd Philadelphia	2.435c.
Del'd New York	2.53c.
F.o.b. Birmingham	2.40c.
F.o.b. cars dock Gulf ports	2.65c.
F.o.b. cars dock Pacific ports	2.80c.
Wrought iron plates, f.o.b. Pittsburgh	3.80c.

Floor Plates

	Base per Lb.
F.o.b. Pittsburgh	3.50c.
F.o.b. Chicago	3.55c.
F.o.b. Coatesville	3.60c.
F.o.b. cars dock Gulf ports	3.90c.
F.o.b. cars dock Pacific ports	4.05c.

Structural Shapes

	Base per Lb.
F.o.b. Pittsburgh	2.25c.
F.o.b. Chicago	2.30c.
Del'd Cleveland	2.435c.
F.o.b. Buffalo or Bethlehem	2.35c.
Del'd Philadelphia	2.455c.
Del'd New York	2.5025c.
F.o.b. Birmingham (standard)	2.40c.
F.o.b. cars dock Gulf ports	2.65c.
F.o.b. cars dock Pacific ports	2.80c.

Steel Sheet Piling

	Base per Lb.
F.o.b. Pittsburgh	2.60c.
F.o.b. Chicago or Buffalo	2.70c.
F.o.b. cars dock Gulf or Pacific Coast ports	3.05c.

RAILS AND TRACK SUPPLIES

F.o.b. Mill

Standard rails, heavier than 60 lb., per gross ton	$42.50
Angle bars, per 100 lb.	2.80

F.o.b. Basing Points

Light rails (from billets) per gross ton	$43.00
Light rails (from rail steel) per gross ton	42.00

	Base per Lb.
Spikes	3.15c.
Tie plates, steel	2.30c.
Tie plates, Pacific Coast ports	2.40c.
Track bolts, to steam railroads	4.35c.
Track bolts, to jobbers, all sizes (per 100 counts)	65-5 per cent off list

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa., Buffalo; on spikes alone, Youngstown, Lebanon, Pa., Richmond, Va.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

	Base per Lb.
No. 10, f.o.b. Pittsburgh	2.40c.
No. 10, f.o.b. Gary	2.50c.
No. 10, del'd Detroit	2.60c.
No. 10, del'd Philadelphia	2.69c.
No. 10, f.o.b. Granite City	2.60c.
No. 10, f.o.b. Birmingham	2.55c.
No. 10, f.o.b. cars dock Pacific ports	2.95c.
No. 10 wrought iron, Pgh.	4.25c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	3.15c.
No. 24, f.o.b. Gary	3.25c.
No. 24, del'd Detroit	3.35c.
No. 24, del'd Philadelphia	3.44c.
No. 24, f.o.b. Granite City	3.35c.
No. 24, f.o.b. Birmingham	3.30c.
No. 24, f.o.b. cars dock Pacific ports	3.80c.
No. 24, wrought iron, Pittsburgh	5.15c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	3.10c.
No. 10 gage, f.o.b. Gary	3.20c.
No. 10 gage, f.o.b. Detroit	3.30c.
No. 10 gage, del'd Philadelphia	3.39c.
No. 10, f.o.b. Granite City	3.30c.
No. 10 gage, f.o.b. Birmingham	3.25c.
No. 10 gage, f.o.b. cars dock Pacific ports	3.70c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	3.55c.
No. 20 gage, f.o.b. Gary	3.65c.
No. 20 gage, del'd Detroit	3.75c.
No. 20 gage, del'd Philadelphia	3.84c.
No. 20, f.o.b. Granite City	3.75c.
No. 20 gage, f.o.b. Birmingham	3.70c.
No. 20 gage, f.o.b. cars, dock, Pacific ports	4.10c.

Galvanized Sheets

No. 24 gage, f.o.b. Pittsburgh	3.80c.
No. 24, f.o.b. Gary	3.90c.
No. 24, del'd Philadelphia	4.09c.
No. 24, f.o.b. Granite City	4.00c.
No. 24, f.o.b. Birmingham	3.90c.
No. 24, f.o.b. cars, dock, Pacific ports	4.40c.
No. 24, wrought iron, Pittsburgh	6.10c.

Electrical Sheets
(F.o.b. Pittsburgh)

	Base per Lb.
Field grade	3.35c.
Armature	3.70c.
Electrical	4.20c.
Special Motor	5.10c.
Special Dynamo	5.80c.
Transformer	6.30c.
Transformer Special	7.30c.
Transformer Extra Special	7.80c.

Base gage changed from 28 to 24 gage. Gage extras are the same as those applying on hot rolled, annealed sheets with few exceptions. *Silicon Strip in coils—Sheet price plus silicon sheet extra width extras plus 25c. per 100 lb. for coils.*

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	4.10c.
F.o.b. Gary	4.20c.
F.o.b. cars, dock, Pacific ports	4.80c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	3.50c.
No. 20, f.o.b. Gary	3.60c.
No. 20, f.o.b. Granite City	3.70c.
No. 20, f.o.b. cars dock Pacific ports	4.10c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh, per lb.	3.30c.
No. 28, Gary	3.40c.
No. 28, f.o.b. Granite City	3.50c.
No. 28, cars dock Pacific ports, boxed	4.175c.

Tin Plate

	Base per Box
Standard cokes, f.o.b. Pittsburgh district mill	$5.35
Standard cokes, f.o.b. Gary	5.45
Standard coke, f.o.b. Granite City	5.55

Above quotations practically the equivalent of previous quotations owing to new method of quoting, effective Jan. 1, 1937.

Special Coated Manufacturing Ternes

	Base per Box
F.o.b. Pittsburgh	*$4.65
F.o.b. Gary	* 4.75
F.o.b. Granite City	4.85

* Customary 7½ per cent discount in effect through 1936 discontinued as of Jan. 1, 1937.

Roofing Terne Plate
(F.o.b. Pittsburgh)

(Per Package, 112 sheets, 20 x 28 in.)	
8-lb. coating I.C.	$12.00
15-lb. coating I.C.	14.00
20-lb. coating I.C.	15.00
25-lb. coating I.C.	16.00
30-lb. coating I.C.	17.25
40-lb. coating I.C.	19.50

Hot-Rolled Hoops, Bands, Strip and Flats under ¼ In.

	Base per Lb
All widths up to 24 in., Pittsburgh	2.40c.
All widths up to 24 in., Chicago	2.50c.
All widths up to 24 in., del'd Detroit	2.60c.
All widths up to 24 in., Granite City	2.60c.
All widths up to 24 in., Birmingham	2.55c.
Cooperage stock, Pittsburgh	2.50c.
Cooperage stock, Chicago	2.60c.

Cold-Rolled Strip*

	Base per Lb
F.o.b. Pittsburgh	3.20c.
F.o.b. Cleveland	3.20c.
Del'd Chicago	3.48c.
F.o.b. Worcester	3.40c.

* Carbon 0.25 and less.

Cold Rolled Spring Steel

		Pittsburgh and Cleveland	Worcester
Carbon	0.25-0.50%	3.20c.	3.40c.
Carbon	.51- .75	4.45c.	4.65c.
Carbon	.76-1.00	6.30c.	6.50c.
Carbon	Over 1.00	8.50c.	8.70c.

Fender Stock

No. 14, Pittsb'gh or Cleveland	3.45c.
No. 20, Pittsb'gh or Cleveland	3.85c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland)

To Manufacturing Trade

	Per Lb.
Bright wire	2.90c.
Galvanized wire	2.95c.
Spring wire	3.50c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To the Trade

	Base per Keg
Standard wire nails	$2.75
Smoth coated nails	$2.75
Cut nails, carloads	$3.60

	Base per 100 Lb.
Annealed fence wire	$3.20
Galvanized fence wire	3.60
Polished staples	3.45
Galvanized staples	3.70
Barbed wire, galvanized	3.40
Twisted barbless wire	3.40
Woven wire fence, base column.	74
Single loop bale ties, base col....	63

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., mill prices are $2 a ton over Pittsburgh, except for woven wire fence, which is $3 over Pittsburgh and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire and staples, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh.

On nails, staples and barbed wire, prices of $6 a ton over Pittsburgh are also quoted at Beaumont and Orange, Tex.

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel			*Wrought Iron*		
In.	Black	Galv.	In.	Black	Galv.
⅛	52	31	¼ & ⅜	+13	+35
¼ to ⅜	55	38½	½	20	1½
½	59½	49	¾	26	8
¾	62½	53	1 & 1¼	30	14
1 to 3	64½	55½	1½	34	16½
			2	33½	16

Lap Weld

2	57	47½	2	26½	10
2½ & 3	60	50½	2½ to 3½	27½	12½
3½ to 6	62	52½	4	29½	16
7 & 8	61	50½	4½ to 8	28½	15
9 & 10	60½	50	9 to 12	24½	10
11 & 12	59½	49			

Butt Weld, extra strong, plain ends

⅛	50½	36½	¼ & ⅜	+14	+48
¼ to ⅜	52½	40½	½	21	4
½	57½	48½	¾	27	10
¾	61½	52½	1 to 2	34	17½
1 to 3	63	55			

Lap Weld, extra strong, plain ends

2	55	46½	2	29½	13½
2½ & 3	59	50½	2½ to 4	35	20½
3½ to 6	62½	54	4½ to 6	33½	19
7 & 8	61½	51	7 & 8	34½	19½
9 & 10	60½	50	9 to 12	28	15½
11 & 12	59½	49			

On butt-weld and lap-weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 9.46	$ 8.41
1¼ in. o.d.	13 B.W.G.	11.21	9.96
1½ in. o.d.	13 B.W.G.	12.38	11.00
1¾ in. o.d.	13 B.W.G.	14.09	12.51
2 in. o.d.	13 B.W.G.	15.78	14.02
2¼ in. o.d.	13 B.W.G.	17.60	15.63
2½ in. o.d.	12 B.W.G.	19.37	17.21
2¾ in. o.d.	12 B.W.G.	21.22	18.85
2¾ in. od.	12 B.W.G.	22.49	19.98
3 in. o.d.	12 B.W.G.	23.60	20.97
4½ in. o.d.	10 B.W.G.	45.19	40.15
3½ in. o.d.	11 B.W.G.	29.79	26.47
4 in. o.d.	10 B.W.G.	36.96	32.83
5 in. o.d.	9 B.W.G.	56.71	50.38
6 in. o.d.	7 B.W.G.	87.07	77.35

Extra for less-carload quantities:

40,000 lb. or ft. or over					Base
30,000 lb. or ft. to	39,999	lb. or ft.			5%
20,000 lb. or ft. to	29,999	lb. or ft.			10%
10,000 lb. or ft. to	19,999	lb. or ft.			20%
5,000 lb. or ft. to	9,999	lb. or ft.			30%
2,000 lb. or ft. to	4,999	lb. or ft.			45%
Under 2,000 lb. or ft					65%

CAST IRON WATER PIPE

	Per Net Ton
*6-in. and larger, del'd Chicago.	$55.00
6-in. and larger, del'd New York	53.00
*6-in. and larger, Birmingham.	47.00
6-in. and larger, f.o.b. dock, San Francisco or Los Angeles....	56.00
F.o.b. dock, Seattle	56.00
4-in. f.o.b. dock, San Francisco or Los Angeles	59.00
F.o.b. dock, Seattle	59.00

Class "A" and gas pipe, $3 extra.
4-in. pipe is $3 a ton above 6-in.

Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $46, Birmingham, and $54 delivered Chicago; and 4-in. pipe, $49, Birmingham, and $58 delivered Chicago.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine and carriage bolts:	
½ in. x 6 in. and smaller	65 and 5*
Larger and longer up to 1 in.	60 and 10*
1⅛ in. and larger	60 and 5*
Lag bolts	60 and 10*
Plow bolts, Nos. 1, 2, 3 and 7	65 and 5
Hot pressed nuts, and c.p.c. and t nuts, square or hex. blank or tapped:	
⅛ in. and smaller	65
9/16 in. to 1 in. inclusive	60 and 5
1⅛ in. and larger	60

* Less carload lots and less than full container quantity. Less carload lots in full container quantity, an additional 10 per cent discount; carload lots and full container quantity, still another 5 per cent discount.

Semi-finished hexagon nuts, U.S.S. and S.A.E.:	
⅛ in. and smaller	60 and 10
9/16 in. to 1 in. inclusive	60 and 5
1⅛ in. and larger	60
Stove bolts in packages, nuts attached	70
Stove bolts in packages, with nuts separate	70 and 10
Stove bolts in bulk	80

On stove bolts freight is allowed to destination on 200 lb. and over.

Large Rivets
(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$3.60
F.o.b. Chicago or Birmingham	3.70

Small Rivets
(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	65 and 5
F.o.b. Cleveland	65 and 5
F.o.b. Chicago and Birmingham	65 and 5

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lb. on lots of 200 lb. or more.)

	Per Cent Off List
Milled cap screws, 1 in. dia. and smaller	50 and 10
Milled standard set screws, case hardened, 1 in dia. and smaller	75
Milled headless set screws, cut thread ¾ in. and smaller	75
Upset hex. head cap screws U.S.S. or S.A.E. thread 1 in. and smaller	60
Upset set screws, cup and oval points	75
Milled studs	65

Alloy and Stainless Steel

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Base price, $60 a gross ton.

Alloy Steel Bars

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.
Open-hearth grade, base | 2.00c.
Delivered, Detroit | 3.15c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
200 (½% Nickel)	$0.35
2100 (1¼% Nickel)	0.75
2300 (3½% Nickel)	1.55
2500 (5% nickel)	$2.35
3100 Nickel-chromium	0.70
3200 Nickel-chromium	1.35
3300 Nickel-chromium	3.80
3400 Nickel-chromium	3.20
4100 Chromium-molybdenum (0.15 to 0.25 Molybdenum)	0.55
4100 Chromium-molybdenum (0.25 to 0.40 Molybdenum)	0.75
4600 Nickel-molybdenum (0.20 to 0.30 Mo, 1.50 to 2.00 Ni)	1.10
5100 Chrome steel (0.60-0.90 Cr.)	0.35
5100 Chrome steel (0.80-1.10 Cr.)	0.45
5100 Chromium spring steel	0.15
6100 Chromium-vanadium bar	1.20
6100 Chromium-vanadium spring steel	0.85
Chromium-nickel-vanadium	1.50
Carbon-vanadium	0.85

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base.

Alloy Cold-Finishd Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 3.60c. base per lb. Delivered Detroit, 3.75c., carlots.

CORROSION & HEAT RESISTANT ALLOYS

(Base prices, cents per lb., f.o.b. Pittsburgh)

Chrome-Nickel

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25c.	24c.
Plates	29c.	27c.
Structural shapes	25c.	24c.
Sheets	36c.	34c.
Hot-rolled strip	23.50c.	21.50c.
Cold-rolled strip	30c.	28c.
Drawn wire	25c.	24c.

Straight Chrome

	No. 410	No. 430	No. 442	No. 446
Bars	18.50c.	19c.	22.50c.	27.50c.
Plates	21.50c.	22c.	25.50c.	30.50c.
Sheets	26.50c.	29c.	32.50c.	36.50c.
Hot strip	17c.	17.50c.	23c.	28c.
Cold stp.	22c.	22.50c.	28.50c.	36.50c.

TOOL STEEL

High speed	80c.
High-carbon-chrome	42c.
Oil-hardening	24c.
Special	22c.
Extra	18c.
Regular	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

British and Continental

BRITISH

Per Gross Ton
f.o.b. United Kingdom Ports

Ferromanganese, export	£20 Nominal
Tin plate, per base box	24s. 6d. to 24s. 9d.
Steel bars, open-hearth	£11
Beams, open-hearth	£11 2s. 6d.
Channels, open-hearth	£11 7s. 6d
Angles, open-hearth	£11 2s. 6d.
Black sheets, No. 24 gage	£15
Galvanized sheets, No. 24 gage	£18 15s.

CONTINENTAL

Per Gross Ton, Gold f. f.o.b. Continental Ports

Billets, Thomas	£4 7s. 6d.
Wire rods, No. 5 B.W.G.	£6 15s.
Steel bars, merchant	£6 to £6 5s.
Sheet bars	£4 8s. 6d.
Plate ¼ in. and up	£6 17s. 6d. to £7
Plate 3/16 in. and 5 mm.	£7 2s. 6d.
Sheet, ⅛ in.	£8 9s. 6d.
Beams, Thomas	£5 2s. 6d.
Angles (Basic)	£6 2s. 6d.
Hoops and strip, base	£7 to £7 5s.

IRON AND STEEL WAREHOUSE PRICES

PITTSBURGH*

	Per Net Ton
Plates	3.70c.
Structural shapes	3.70c.
Soft-steel bars and small shapes	3.80c.
Reinforcing steel bars	3.80c.
Cold-finished and screw stock:	
Rounds and hexagons	4.15c.
Squares and flats	4.15c.
Hot rolled strip incl. 3/16 in. thick, under 24 in. wide	4.00c.
Hoops	4.50c.
Hot-rolled annealed sheets (No. 24), 10 or more bundles	4.50c.
Galv. sheets (No. 24), 10 or more bundles	5.15c.
Hot-rolled sheets (No. 10)	3.75c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$4.48
Spikes, large .....1 to 24 kegs	3.90c.
	Per Cent Off List
Track bolts, all sizes per 100 count	55
Machine bolts, 100 count	**
Carriage bolts, 100 count	**
Nuts, all styles, 100 count	**
Large rivets, base per 100 lb.	$4.35
Wire, black, soft ann'l'd, base per 100 lb.	3.45c.
Wire, galv. soft, base per 100 lb.	3.85c.
Common wire nails, per keg	3.00c.
Cement coated nails, per keg	3.00c.

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lb.

* Delivered in Pittsburgh switching district.

** Prices on application.

CHICAGO *Base per Lb.*

Plates and structural shapes	3.75c.
Soft steel bars, rounds	3.85c.
Soft steel bars, squares and hexagons	4.00c.
Cold-fin. steel bars:	
Rounds and hexagons	4.30c.
Flats and squares	4.30c.
Hot-rolled strip	4.10c.
Hot-rolled annealed sheets (No. 24)	4.60c.
Galv. sheets (No. 24)	5.25c.
Spikes (keg lots)	$4.40
Track bolts (keg lots)	5.05
Rivets, structural (keg lots)	**4.95
Rivets, boiler (keg lots)	**5.05
	Per Cent Off List
Machine bolts and carriage bolts, ½ in. and smaller	60
Lag screws	*55 and 5
Hot-pressed nuts, sq. and hex., tap or blank, ½ by 6 in. and smaller	60
Hex. head cap screws	60
Cut point set screws	75
Flat head bright wood screws	62 and 20
Spring cotters	45
Stove bolts in full packages	72½
Rd. hd. tank rivets, 7/16 in. and smaller	55
Wrought washers	$4.00 off list
Black ann'l'd wire per 100 lb. to mfg. trade (No. 14 and heavier)	$4.55
Com. wire nails, 15 kegs or more, per keg	$3.20
Cement c't'd nails, 15 kegs or more, per keg	$3.20

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 3999 lb. All prices are f.o.b. consumers' plants within the Chicago switching district.

* These are quotations delivered to city trade for quantities of 100 lb. or more. For lots of less than 100 lb., the quotation is 60 per cent off. Discounts applying to country trade are 70 per cent off, f.o.b. Chicago, with full or partial freight allowed up to 50c. per 100 lb.

** Base at 100 lb.

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	4.00c.
Structural shapes	3.97c.
Soft steel bars, round	4.12c.
Iron bars, Swed. charcoal	7.25 to 7.50c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	4.57c.
Flats and squares	4.57c.
Cold-rolled; strip, soft and quarter hard	3.92c.
Hoops	4.32c.
Bands	4.32c.
Hot-rolled sheets (No. 10)	4.00 to 4.07c.
Hot-rolled ann'l'd sheets (No. 24*)	4.50 to 4.32c.
Galvanized sheets (No. 24*)	4.50 to 5.47c.
Long terne sheets (No. 24)	5.50 to 6.20c.
Armco iron, galv. (No. 24†)	6.25c.
Toncan iron, galv. (No. 24†)	6.25c.
Galvanneal (No. 24†)	6.60c.
Armco iron, hot-rolled annealed (No. 24†)	5.65c.
Toncan iron, hot-rolled annealed (No. 24†)	5.65c.
Armco iron hot-rolled (No. 10†)	4.60c.
Toncan iron, hot-rolled (No. 10†)	4.60c.
Cold-rolled sheets (No. 20) for quantities 400 to 1499 lb.	
Standard quality	5.40c.
Deep drawing	6.05c.
Stretcher leveled	6.05c.
SAE, 2300, hot-rolled	7.82c.
SAE, 3100, hot-rolled	6.37c.
SAE, 6100, hot-rolled, annealed	10.52c.
SAE, 2300, cold-rolled	9.00c.
SAE, 3100, cold-rolled, annealed	8.35c.
Floor plate, ⅛ in. and heavier	5.60c.
Standard tool steel	12.50c.
Wire, black, annealed (No. 9)	4.25c.
Wire, galv. (No. 9)	4.60c.
Tire steel, 1 x ½ in. and larger	4.61c.
Open-hearth spring steel	4.75c. to 10.25c.
Common wire nails, base per keg	3.25c.
	Per Cent Off List
Machine bolts, square head and nut: All diameters. Prices on application	
Carriage bolts, cut thread: All diameters. Prices on application	

* No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

† 125 lb. and more.

ST. LOUIS

	Base per Lb.
Plates and struc. shapes	3.99c.
Bars, soft steel (rounds and flats)	4.09c.
Bars, soft steel (squares, hexagons, ovals, half ovals and half rounds)	4.24c.
Cold-fin. rounds, shafting, screw stock	4.54c.
Hot-rolled annealed sheets (No. 24)	4.84c.
Galv. sheets (No. 24*)	5.49c.
Hot-rolled sheets (No. 10)	4.09c.
Black corrug. sheets (No. 24*)	4.89c.
2 galv. corrug. sheets	5.54c.
Structural rivets	5.29c.
Boiler rivets	5.39c.
	Per Cent Off List
Tank rivets, 7/16 in. and smaller	50
Machine and carriage bolts, lag screws, fitting up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts; all quantities	60

* No. 26 and lighter take special prices.

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	3.90c.
*Structural shapes	3.90c.
*Soft steel bars, small shapes, iron bars (except bands)	4.00c.
‡Reinforc. steel bars, sq. twisted and deformed	3.53c.
Cold-finished steel bars	4.53c.
*Steel hoops	4.35c.
*Steel bands, No. 12 and 3/16 in. incl.	4.10c.
*Spring steel	5.50c.
†Hot-rolled anneal. sheets (No. 24)	4.65c.
†Galvanized sheets (No. 24)	5.30c.
*Hot-rolled annealed sheets (No. 10)	4.00c.
*Diam. pat. floor plates, ¼ in.	5.25c.

These prices are for delivery in Philadelphia trucking area.

* Base prices subject to deduction on orders aggregating 4000 lb. or over.

† For 25 bundles or over.

‡ For less than 2000 lb.

CLEVELAND

	Base per Lb.
Plates and struc. shapes	3.86c.
Soft steel bars	3.75c.
†Reinforc. steel bars	2.60c.
‡Cold-finished steel bars	4.30c.
Hot-rolled strip, 6 in. wide and under	4.16c.
Cold-finished strip	3.60c.
Hot-rolled annealed sheets (No. 24)	4.66c.
Galvanized sheets (No. 24)	5.31c.
Hot-rolled sheets (No. 10)	3.91c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.91c.
Floor plates, 3/16 in. and heavier	5.76c.
*Black ann'l'd wire, per 100 lb.	$3.40
*No. 9 galv. wire, per 100 lb.	3.80
*Com. wire nails, base per keg	2.95
	Per Cent Off List
Machine and carriage bolts, small	65 and 5
Large	60 and 10
Nuts, 100 count	
½ in. and smaller	65 and 5
9/16 in. to 1 in.	60 and 10

† Outside delivery 10c. less.

* For 5000 lb. or less.

‡ Plus switching and cartage charges and quantity differentials up to 50c.

CINCINNATI

	Base per Lb.
Plates and struc. shapes	3.95c.
Floor plates	5.55c.
Bars, rounds, flats and angles	4.05c.
Other shapes	4.20c.
Rail steel reinforc. bars	3.75c.
Hoops and bands, 3/16 in. and lighter	4.25c.
Cold-finished bars	4.50c.
Hot-rolled annealed sheets (No. 24) 3500 lb. or more	4.60c.
Galv. sheets (No. 24) 3500 lb. or more	$5.25
Hot-rolled sheets (No. 10)	4.00c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$3.48
Com. wire nails, base per keg:	
Any quantity less than carload	3.20
Cement c't'd nails, base 100-lb. keg	3.50
Chain, lin. per 100 lb.	8.35
	Net per 100 Ft.
Seamless steel boiler tubes, 2-in.	$21.80
4-in.	52.45
Lap-welded steel boiler tubes, 2-in.	20.73
4-in.	48.41

BUFFALO *Base per Lb.*

Plates	3.92c.
Floor plates	5.52c.
Struc. shapes	3.80c.
Soft steel bars	3.90c.
Reinforcing bars	3.10c.
Cold-fin. flats and sq.	4.35c.
Rounds and hex.	4.35c.
Cold-rolled strip steel	3.79c.
Hot-rolled annealed sheets (No. 24)	4.80c.
Heavy hot-rolled sheets (3/16 in., 24 to 48 in. wide)	3.97c.
Galv. sheet (No. 24)	5.45c.
Bands	4.22c.
Hoops	4.22c.
Heavy hot-rolled sheets	3.97c.
Com. wire nails, base per keg	$3.26
Black wire, base per 100 lb. (2500-lb. lots or under)	4.55c.
(Over 2500 lb.)	4.45c.

BOSTON

	Base per Lb.
Channels, angles	4.20c.
Tees and zees, under 3"	4.45c.
H beams and shapes	4.07c.
Plates — Sheared, tank and univ. mill, ¼ thick and heavier	4.08c.
Floor plates, diamond pattern	5.13c.
Bar and bar shapes (mild steel)	4.20c.
Bands 3/16 in. thick and No. 12 ga. incl.	4.40 to 5.40
Half rounds, half ovals, ovals and bevels	5.45c.
Tire steel	5.45c.
Cold-rolled strip steel	3.845c.
Cold-finished rounds, squares and hexagons	4.65c.
Cold-finished flats	4.65c.
Blue annealed sheets, No. 10 ga.	3.90c.
One pass cold-rolled sheets No. 24 ga.	4.50c.
Galvanized steel sheets, No. 24 ga.	5.05c.
Lead coated sheets, No. 24 ga.	6.15c.

Price delivered by truck in metropolitan Boston, subject to quantity differentials.

DETROIT

	Base per Lb.
Soft steel bars	3.49c.
Structural shapes	3.95c.
Plates	3.95c.
Floor plates	5.85c.
Hot-rolled annealed sheets (No. 24)*	4.69c.
Hot-rolled sheets (No. 10)	3.94c.
Galvanized sheets (No. 24)*	5.40c.
Bands and hoops	4.19c.
Cold-finished bars	4.30c.
Cold-rolled strip	3.78c.
Hot-rolled alloy steel (S.A.E. 3100 Series)	6.44c.

Quantity differential on bars, plates, structural shapes, bands, hoops, floor plates and heavy hot-rolled: Under 100 lb., 1.50c. over base; 100 to 399 lb., base plus .50c.; 400 to 3999 lb. base; 4000 to 9999 lb., base less .10c.; 10,000 lb. and over, less .15c.

*Under 400 lb., .50c. over base, 400 to 1499 lb., base; 1500 to 3499 lb., base less .10c; 3500 lb. and over, base less 15c.

Prices delivered by truck in metropolitan Detroit, subject to quantity differentials covering shipment at one time.

Galvanized and hot-rolled annealed may not be combined to obtain quantity deductions.

MILWAUKEE

	Base per Lb.
Plates and structural shapes	3.86c.
Soft steel bars, rounds up to 8 in., flats and fillet angles	3.96c.
Soft steel bars, squares and hexagons	4.11c.
Hot-rolled strip	4.21c.
Hot-rolled annealed sheets (No. 24)	4.71c.
Galvanized sheets (No. 24)	5.36c.
Cold-finished steel bars	4.41c.
Structural rivets (keg lots)	5.16c.
Boiler rivets, cone head (keg lots)	5.26c.
Track spikes (keg lots)	4.61c.
Track bolts (keg lots)	5.81c.
Black annealed wire (No. 6 to No. 9 incl.)	4.05c.
Com. wire nails and cement coated nails 1 to 14 kegs	3.25c.

	Per Cent Off List
Machine bolts and carriage bolts, ½x6 and smaller or shorter	65
Larger and longer up to 1 in., diam.	60-5
1⅛ in. and larger	60
Coach and lag screws	60-5
Hot-pressed nuts, sq. and hex. tapped or blank, 1-199 lb.	50
200 lb. and over:	
⅛ in. and smaller	62½
9/16 to 1 in.	60
1⅛ in. and over	50

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 3999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on orders of 400 to 1500 lb. On cold-finished bars the prices are for orders of 1000 lb. or more of a size.

ST. PAUL

	Base per Lb.
Mild steel bars, rounds	4.10c.
Structural shapes	4.00c.
Plates	4.00c.
Cold-finished bars	4.55c.
Hot-rolled annealed sheets, No. 24	4.85c.
Galvanized sheets, No. 24	5.50c.

On mild steel bars, shapes and plates the base applies on 400 to 14,999 lb. On hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over. Base on cold-finished bars is 1000 lb. and over of a size.

BALTIMORE

	Base per Lb.
Mild steel bars and small shapes	4.00c.
Structural shapes	3.90c.
Reinforcing bars, 5 to 15 tons	3.16c.
Plates	3.90c.
Hot-rolled sheets, No. 10	3.95c.
Bands	4.20c.
Hoops	4.45c.
Special threading steel	4.15c.
Checkered floor plates ¼ in. and heavier	5.50c.
Galvanized sheets, No. 24, 100 bdls. or more	$4.70
Cold-rolled rounds, hexagons, squares and flats, 1000 lb. and more	$4.50

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets the base applies on orders 400 to 3999 lb.

All prices are f.o.b. consumers' plants.

For second zone add 10c. per 100 lb. for trucking.

CHATTANOOGA

	Base per Lb.
Mild steel bars	4.21c.
Iron bars	4.21c.
Reinforcing bars	4.21c.
Reinforcing shapes	4.11c.
Plates	4.11c.
Hot-rolled sheets No. 10	4.16c.
Hot-rolled annealed sheets, No. 24*	4.06c.
Galvanized sheets No. 24*	4.76c.
Steel bands	4.41c.
Cold-finished bars	4.86c.

* Plus mill item extra.

MEMPHIS

	Base per Lb.
Mild steel bars	4.31c.
Shapes, bar size	4.31c.
Iron bars	4.31c.
Structural shapes	4.21c.
Plates	4.21c.
Hot-rolled sheets, No. 10	4.26c.
Hot-rolled annealed sheets, No. 24	4.91c.
Galvanized sheets, No. 24	5.66c.
Steel bands	4.56c.
Cold-drawn rounds	4.80c.
Cold-drawn flats, squares, hexagons	6.80c.
Structural rivets	5.15c.
Bolts and nuts, per cent off list	55
Small rivets, per cent off list	55

NEW ORLEANS

	Base per Lb.
Mild steel bars	4.20c.
Reinforcing bars	3.24c.
Structural shapes	4.10c.
Plates	4.10c.
Hot-rolled sheets, No. 10	4.35c.
Steel bands	4.75c.
Cold-finished steel bars	5.10c.
Structural rivets	4.85c.
Boiler rivets	4.85c.
Common wire nails, base per keg	$3.55
Bolts and nuts, per cent off list	60

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	4.05c.	4.30c.	4.25c.
Shapes, standard	4.05c.	4.30c.	4.25c.
Soft steel bars	4.20c.	4.30c.	4.45c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.975c.	2.975c.	3.625c.
Hot-rolled annealed sheets (No. 24)	5.15c.	5.05c.	5.35c.
Hot-rolled sheets (No. 10)	4.30c.	4.50c.	4.50c.
Galv. sheets (No. 24 and lighter)	5.35c.	5.55c.	5.90c.
Galv. sheets (No. 22 and heavier)	6.10c.	5.70c.	5.90c.
Cold-finished steel Rounds	6.30c.	6.35c.	7.10c.
Squares and hexagons	8.05c.	8.10c.	7.10c.
Flats	8.55c.	8.60c.	8.10c.
Common wire nails—base per keg less carload	$3.65	$3.60	$3.70

All items subject to differentials for quantity.

REFRACTORIES PRICES

Fire Clay Brick

	Per 1000 f.o.b. Works
First quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	$54.00
First quality, New Jersey	56.00
Select, Ohio	49.00
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	49.00
Second quality, New Jersey	51.00
No. 1, Ohio	46.00
Ground fire clay, per ton	8.00

5 per cent trade discount on fire clay brick, except for New Jersey, quoted at net price.

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$54.00
Chicago District	63.00
Birmingham	54.00
Silica cement per net ton (Eastern)	9.50

5 per cent trade discount on silica brick.

Chrome Brick

	Per Net Ton
Standard f.o.b. Baltimore, Plymouth Meeting and Chester	$49.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	49.00

Magnesite Brick

	Per Net Ton
Standard f.o.b. Baltimore and Chester	$69.00
Chemically bonded, f.o.b. Baltimore	59.00

Grain Magnesite

	Per Net Ton
Imported, f.o.b. Baltimore and Chester, Pa. (in sacks)	$45.00
Domestic, f.o.b. Baltimore and Chester, in sacks	43.00
Domestic, f.o.b. Chewelah, Wash.	25.00

RAW MATERIALS PRICES

PIG IRON

No. 2 Foundry

F.o.b. Everett, Mass.	$25.75
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa., and Sparrows Point, Md.	25.00
Delivered Brooklyn	27.27
Delivered Newark or Jersey City	26.39
Delivered Philadelphia	25.76
F.o.b. Neville Island, Sharpsville and Erie, Pa.; Buffalo, Youngstown, Cleveland, Toledo and Hamilton, Ohio; Detroit; Chicago and Granite City, Ill.	24.00
F.o.b. Jackson, Ohio	25.75
Delivered Cincinnati	24.07
F.o.b. Duluth	24.50
F.o.b. Provo, Utah	22.00
Delivered San Francisco, Los Angeles or Seattle	$26.50
F.o.b. Birmingham*	20.38

* Delivered prices on southern iron for shipment to northern points are 38c. a ton below delivered prices from nearest northern basing point on iron with phosphorus content of 70 and over.

Malleable

Base prices on malleable iron are 50c. a ton above No. 2 foundry quotations at Everett, Eastern Pennsylvania furnaces, Erie and Buffalo. Elsewhere they are the same.

Basic

F.o.b. Everett, Mass.	$25.75
F.o.b. Bethlehem, Birdsboro, Swedeland and Steelton, Pa., and Sparrows Point, Md.	24.50
F.o.b. Buffalo	23.00
F.o.b. Neville Island, Sharpsville and Erie, Pa.; Youngstown, Cleveland, Toledo and Hamilton, Ohio; Detroit; Chicago and Granite City, Ill.	23.50
Delivered Cincinnati	24.51
Delivered Canton, Ohio	24.76
Delivered Mansfield, Ohio	25.26
F.o.b. Jackson, Ohio	25.50
F.o.b. Birmingham	19.00

Bessemer

F.o.b. Everett, Mass.	$26.75
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa.	26.00
Delivered Boston Switching District	26.50
Delivered Newark or Jersey City	27.39
Delivered Philadelphia	26.76
F.o.b. Buffalo and Erie, Pa., and Duluth	25.00
F.o.b. Neville Island and Sharpsville, Pa.; Youngstown, Cleveland, Toledo and Hamilton, Ohio; Detroit; Chicago	24.50
F.o.b. Birmingham	25.00
Delivered Cincinnati	25.51
Delivered Canton, Ohio	25.76
Delivered Mansfield, Ohio	26.26

Low Phosphorus

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y.	$28.50

Gray Forge

Valley or Pittsburgh furnace	$23.50

Charcoal

Lake Superior furnace	$27.00
Delivered Chicago	30.04

Canadian Pig Iron

Per Gross Ton

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75	$26.50
No. 2 fdy., sil. 1.75 to 2.25	25.50
Malleable	26.00
Basic	25.50

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75	$27.50
No. 2 fdy., sil. 1.75 to 2.25	27.00
Malleable	27.50
Basic	27.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

Per Gross Ton

Domestic, 80% (carload)	$102.50

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%	$33.00
F.o.b. New Orleans	33.00

Electric Ferrosilicon

Per Gross Ton Delivered

50% (carloads)	$69.50
50% (ton lots)	77.00
75% (carloads)	126.00
75% (ton lots)	136.00

Silvery Iron

Per Gross Ton

F.o.b. Jackson, Ohio, 5.00 to 5.50%	$27.50

For each additional 0.5% silicon up to 17%, 50c. a ton is added.

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese, each unit over 2%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton

10.00 to 10.50%	$33.50
10.51 to 11.00%	34.00
11.01 to 11.50%	34.50
11.51 to 12.00%	35.00
12.01 to 12.50%	35.50
12.51 to 13.00%	36.00
13.01 to 13.50%	36.50
13.51 to 14.00%	37.00
14.01 to 14.50%	37.50
14.51 to 15.00%	38.00
15.01 to 15.50%	38.50
15.51 to 16.00%	39.00
16.01 to 16.50%	39.50
16.51 to 17.00%	40.00

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W del., carloads, nominally	$1.80
Ferrotungsten, lots of 5000 lbs., nominally	1.85
Ferrotungsten, smaller lots, nominally	1.90
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr per lb. contained Cr delivered, in carloads, and contract	10.50c.*
Ferrochromium, 2% carbon	16.50c. to 17.00c.*
Ferrochromium, 1% carbon	17.50c. to 18.00c.*
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.*
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.*
Ferrovanadium, del. per lb. contained V.	$2.70 to $2.90
Ferrocolumbium, per lb. contained columbium, f.o.b. Niagara Falls, N. Y.	$2.50*
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace carload and contract per net ton	$142.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton	$157.50
Ferrophosphorus, electric, or blast furnace material, in carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton	63.50
Ferrophosphorus, electric, 24%, in carlots, f.o.b. Anniston, Ala., per gross ton with $3 unitage, freight equalized with Nashville, Tenn.	80.00
Ferromolybdenum, per lb. Mo del.	95c.
Calcium molybdate, per lb. Mo del.	80c.
Silico spiegel, per ton, f.o.b. furnace, carloads	$45.00
Ton lots or less, per ton	50.00
Silico-manganese, gross ton, delivered.	
3%	101.50
2.50% carbon grade	106.50
2% carbon grade	111.50
1% carbon grade	121.50

* Spot prices are $5 a ton higher. Spot premium on 75 per cent ferrosilicon is $10 a ton.

ORES

Lake Superior Ores

Delivered Lower Lake Ports

Per Gross Ton

Old range, Bessemer, 51.50%	$5.25
Old range, non-Bessemer, 51.50%	5.10
Mesabi, Bessemer, 51.50%	5.10
Mesabi, non-Bessemer, 51.50%	$4.95
High phosphorus, 51.50%	4.85

Foreign Ore

C.i.f. Philadelphia or Baltimore

Per Unit

Iron, low phos., copper free, 55 to 58% dry, Algeria, nominal	17.00c
Iron, low phos., Swedish, average, 68½% iron	Nominal
Iron, basic or foundry, Swedish, aver. 65% iron	Nominal
Iron, basic or foundry, Russian, aver. 65% iron	Nominal
Man., Caucasian, washed 52%	50c.
Man., African, Indian, 44-48%	Nominal
Man., African, Indian, 49-51%	Nominal
Man., Brazilian, 46 to 48½%	Nominal

Per Net Ton Unit

Tungsten, Chinese, wolframite, duty paid, delivered, nominal	$28.00 to $30.00
Tungsten, domestic, scheelite delivered, nominally	$25.00 to $29.00
Chrome ore (lump) c.i.f. Atlantic Seaboard, per gross ton:	
South African (low grade)	$16.00
Rhodesian, 45%	23.00
Rhodesian, 48%	26.75
Turkish, 48-49%	25.50 to $26.50
Turkish, 45-46%	23.50 to 24.00
Turkish, 44%	19.00 to 19.50
Chrome concentrates (Turkish) c.i.f Atlantic Seaboard, per gross ton:	
50%	$25.50 to $26.50
48-49%	24.50 to 25.00

FLUORSPAR

Per Net Ton

Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines, all rail	$20.00
Domestic, barge and rail	21.50
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	22.00
Foreign, 85% calcium, fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	24.50
Domestic No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	31.50

FUEL OIL

Per Gal.

F.o.b. Bayonne or Baltimore, No. 3 distillate	5.25c.
F.o.b. Bayonne or Baltimore, No. 4 industrial	5.25c.
Del'd Ch'go, No. 3 industrial	4.15c.
Del'd Ch'go, No. 5 industrial	4.00c.
Del'd Cleve'd, No. 3 distillate	5.75c.
Del'd Cleve'd No. 4 industrial	5.75c.
Del'd Cleve'd No. 5 industrial	5.00c.

COKE AND COAL

Coke	*Per Net Ton*
Furnace, f.o.b. Connellsville, Prompt	$4.25 to $4.50
Foundry, f.o.b. Connellsville, Prompt	5.00 to 6.25
Foundry, by-product, Chicago ovens	10.25
Foundry, by-product, del'd New England	12.50
Foundry, by-product, del'd Newark or Jersey City	10.85 to 11.30
Foundry, by-product, Philadelphia	10.60
Foundry, by-product, delivered Cleveland	11.00
Foundry, by-product, delivered Cincinnati	10.50
Foundry, Birmingham	7.50
Foundry, by-product, del'd St. Louis industrial district	11.00 to 11.50
Foundry, from Birmingham, f.o.b. cars docks, Pacific ports	14.75

Coal	*Per Net Ton*
Mine run steam coal, f.o.b. W. Pa. mines	$1.50 to $1.75
Mine run coking coal, f.o.b. W. Pa.	1.75 to 1.90
Gas coal, ¾-in. f.o.b. Pa. mines	2.00 to 2.25
Mine run gas coal, f.o.b. Pa. mines	1.80 to 2.00
Steam slack, f.o.b. W. Pa. mines	1.00 to 1.25
Gas slack, f.o.b. W. Pa. mines	1.20 to 1.45

FOR *High Quality Steels*

NIAGARA
BRAND
FERRO-ALLOYS

FERRO SILICON
ALL GRADES

FERRO CHROMIUM
HIGH CARBON

FERRO CHROMIUM
LOW CARBON

FERRO MANGANESE
SILICO MANGANESE

PITTSBURGH METALLURGICAL CO., Inc.

NIAGARA FALLS, N. Y.

SALES OFFICES: NEW YORK—30 Church St. • PITTSBURGH—Oliver Bldg. • CLEVELAND—Hanna Bldg.

Imports (In Gross Tons)	August		Eight Months Ended August	
	1937	1936	1937	1936
Pig iron	7,952	12,524	76,127	122,527
Sponge iron	52	....	2,180	1,380
Ferromanganese[1]	812	1,942	20,662	15,345
Spiegeleisen	1,442	5,249	13,894	26,634
Ferrochrome[2]	7	18	240	21
Ferrosilicon[3]	376	21	1,880	446
Other ferroalloys[4]	....	....	52	426
Scrap	23,110	12,518	61,691	88,207
Pig iron, ferroalloys and scrap	*33,751*	*32,272*	*176,726*	*254,986*
Steel ingots, blooms, etc.	....	8	124	69
Billets, whether solid or hollow	146	125	1,385	533
Wire rods	1,475	1,722	10,839	12,772
Semi-finished steel	*1,621*	*1,855*	*12,348*	*13,374*
Concrete reinforcement bars	58	1,012	3,603	3,085
Hollow steel bars	238	196	1,759	1,345
Merchant steel bars	2,894	3,557	36,276	24,652
Iron slabs	....	....	1	....
Iron bars	111	98	1,341	872
Boiler and other plate	5	150	204	202
Sheets, skelp, and saw plate	120	2,062	8,325	13,918
Die blocks or blanks, etc.	14	42	91	155
Tin plate	10	....	162	140
Structural shapes	4,150	7,264	62,015	35,924
Sheet piling	399	81	2,161	2,151
Rails and track material	136	542	6,539	4,947
Welded pipe	1,105	546	7,107	3,755
Other pipe	9,866	3,384	25,990	13,981
Cotton ties	....	601	454	1,466
Other hoops and bands	1,784	2,683	20,995	15,599
Barbed wire	1,781	1,038	10,638	11,206
Round iron and steel wire	493	530	3,478	3,330
Telegraph and telephone wire	4	1	16	35
Flat wire and steel strips	307	283	2,443	1,933
Wire rope and strand	237	171	2,498	1,620
Other wire	79	180	2,840	1,007
Nails, tacks and staples	1,368	1,818	12,716	16,280
Bolts, nuts and rivets	109	94	467	386
Horse and mule shoes	94	28	277	259
Rolled and finished steel	*25,362*	*26,361*	*212,396*	*158,248*
Malleable iron pipe fittings	33	14	287	84
Cast iron pipe and fittings	181	59	1,958	298
Castings and forgings	541	127	3,300	783
Total	61,489	60,688	407,015	427,773

[1] Manganese content. [2] Chrome content. [3] Silicon content. [4] Alloy content.

Exports (In Gross Tons)	August		Eight Months Ended August	
	1937	1936	1937	1936
Pig iron	114,035	320	588,424	1,369
Ferromanganese and spiegeleisen	120	44	1,625	318
Other ferroalloys	167	668	1,448	1,816
Scrap, iron and steel	473,933	194,600	3,028,795	1,432,843
Scrap, tin plate	2,975	1,082	22,590	10,184
Waste-waste tin plate	1,388	3,967	27,618	25,537
Pig iron, ferroalloys and scrap	*592,618*	*200,681*	*3,670,500*	*1,472,067*
Ingots, blooms, billets, sheet bars	68,467	1,303	173,342	12,401
Ingots, etc., alloy steel incl. stainless	834	....	4,998	....
Skelp	6,666	5,675	58,167	27,501
Wire rods	7,858	2,533	35,997	25,596
Semi-finished steel	*83,825*	*9,511*	*272,504*	*65,498*
Bars, plain and reinforcing	14,255	4,731	90,523	34,908
Bars, alloy steel	392	....	4,320	....
Bars, stainless steel	9	....	171	....
Iron bars	108	34	1,818	788
Plates, plain and fabricated	54,998	7,542	244,546	46,043
Plates, alloy steel	33	....	2,335	....
Plates, stainless	3	....	28	....
Sheets, galvanized steel	7,258	4,072	48,268	36,273
Sheets, galvanized iron	567	211	3,570	1,061
Sheets, black, plain steel	27,118	7,115	178,832	88,990
Sheets, alloy steel	507	....	3,551	....
Sheets, stainless	450	....	881	....
Sheets, black iron	957	738	7,109	5,169
Hoops, bands, strips, plain steel	7,611	4,906	75,677	40,343
Hoops, bands, strip steel, alloy	61	....	914	....
Hoops, bands, strip steel, stainless	31	....	393	....
Tin plate and taggers' tin	29,170	14,641	213,267	162,357
Terne plate (including long terne)	430	77	3,688	2,478
Structural shapes, plain material	16,636	5,226	98,719	36,443
Structural material, fabricated	2,681	959	24,085	11,354
Sheet piling	1,180	146	3,475	1,745
Tanks, steel	2,566	1,939	20,910	15,990
Steel rails	7,890	12,126	68,987	51,390
Rail fastenings, switches, spikes, etc.	1,420	1,853	11,793	8,560
Boiler tubes	1,349	784	8,912	4,452
Casing and oil line pipe	7,109	3,033	63,148	16,057
Pipe, black and galv., welded steel	3,112	1,414	28,840	13,159
Pipe, black and galv., welded iron	652	239	4,970	2,547
Plain and galvanized wire	6,098	3,264	42,113	29,594
Barbed wire and woven wire products	4,193	2,641	28,867	22,587
Wire rope and other products	2,343	595	11,657	5,390
Nails and tacks	773	754	16,255	7,394
Bolts, nuts, rivets and washers except track	731	492	7,640	4,080
Other finished steel	258	85	1,987	1,402
Rolled and finished steel	*202,949*	*79,617*	*1,322,249*	*650,554*
Cast iron pipe and fittings	2,149	3,546	22,162	13,061
Malleable iron screwed fittings	359	232	3,477	2,152
Carwheels and axles	1,717	687	10,934	4,867
Castings, iron and steel	1,263	892	9,186	6,967
Castings, alloy steel, incl. stainless	130	....	1,111	....
Forgings, plain	1,189	175	5,779	2,718
Forgings, alloy steel, incl. stainless	120	....	622	....
Castings and forgings	*6,927*	*5,532*	*53,271*	*29,765*
Total	886,319	295,341	5,318,524	2,217,884

Lower Iron and Steel Imports in August

THE United States imported in August 38,379 gross tons of iron and steel products (excluding scrap) in comparison with 41,388 tons in the preceding month and 48,170 tons in the corresponding month of 1936, according to preliminary information released by the Metals and Minerals Division, Bureau of Foreign and Domestic Commerce.

Despite the lower August volume, the value at $2,543,241, compares with only $2,084,401 in July and $2,092,517 in August, 1936. Increases of 22 per cent in value were recorded over July and 21.4 per cent over August last year. A heavy increase in steel pipe imports during August contributed chiefly to the sharp value rise. These expanded sharply from 2205 tons in July to 11,185 in August. The outstanding countries of supply were Germany, 10,296 tons; Sweden, 375 tons and Canada 250 tons. The second item of importance was pig iron, totaling 7952 tons. Germany was the principal supplier of iron and steel products (excluding scrap) in August, with a total of 14,368 tons made up chiefly of pipe (10,296), barbed wire (1494), and nails, tacks, and staples (1228 tons).

The cumulative import total for the first eight months of 1937 was 345,324 tons, valued at $17,628,175, in comparison with 339,566 tons, valued at $13,942,263 for the like period of 1936, or increases of 1.7 per cent in quantity and 26.4 per cent in value.

Details of exports of iron and steel products from the United States appeared last week on page 93.

August Imports of Iron and Manganese Ores

(In Gross Tons)

	Iron Ore		Manganese Concentrates, 35 Per Cent or Over	
	1937	1936	1937	1936
Canada	1,200	15,017	53	....
Cuba	60,000	44,500	2,122	....
Chile	99,450	108,900	....	....
Spain	....	....	....	....
Norway	14,459	15,002	....	....
Sweden	21,471	32,852	....	....
French Africa	....	....	....	....
Russia	....	....	24,547	....
India	....	....	3,834	10,387
Brazil	....	1	9,274	4,543
Gold Coast	....	....	9,110	21,208
Other countries	10,245	17,359	....	....
Total	206,825	233,631	48,940	36,138

THIS WEEK'S MACHINE . . .TOOL ACTIVITIES. . .

. . . New bookings show a tendency to slow up.

o o o

. . . Presses most active line, with several large lists yet to be opened.

Cleveland

MACHINE tool business shows little change so far this month as compared with September. Dealers report that orders and inquiries are light, and some prospective purchasers are showing hesitancy about buying machines. Orders are mostly for single tools, and no sizable lists are pending. The New York Central Railroad has revived an inquiry for a 52-in. boring mill. Deliveries have improved considerably with some manufacturers, but others show little gain. Manufacturers of forging machinery report an improvement in inquiry largely from agricultural implement manufacturers.

While domestic business is lacking, foreign demand is brisk, fresh inquiries having come out in the last few days from several European countries. Russia has been a heavy buyer lately. Sales of lathes to Russia recently reported have been augmented by another purchase making a total of 90 machines placed with one manufacturer. Slackening of domestic business has enabled one machine tool builder who has been taking export business on the quota basis to advance its delivery dates on foreign business from March to December. However, there has also been some improvement in deliveries by competing manufacturers in England.

Russia is also a purchaser of considerable press equipment, placing an order during the week for 16 large presses for forming automobile bodies, this order amounted to approximately $500,000. Domestic orders for presses continue good. The inquiries for a large amount of press equipment for the new Ford Motor plant in Detroit and the Kelsey Wheel plant in the Pittsburgh territory are expected out in the next few days.

New York

MACHINERY buying in the first few days of the month seems to have largely been a carryover from late September business, and now that that is over, there is a noticeable drop in both orders and inquiries. Billings are being maintained at a high level, as shipments go forward on old orders, but there is evidence of an apparent tendency to hold up new commitments. Chief activity in production and in machine tool purchasing is among those concerns enjoying Government contracts for the manufacture of aircraft engines and parts and for naval construction. Several industrial machinery manufacturers, on the other hand, have reduced their backlogs and have laid off their night shifts. Other layoffs due to recession of activity are also reported. The outlook is not altogether gloomy, however, and a number of machinery representatives expect October to be a fair month.

A large amount of foreign business is being placed. During the past 10 days millions of dollars' worth of orders have been received by manufacturers from Russian and Japanese sources. Machinery being purchased by the Soviets is for aircraft manufacture and for the development of heavy industries in connection with the third Five-Year Plan, commencing in 1938. Delivery on some equipment is being extended all through 1938 and well into 1939. The Japanese are buying tools for aircraft manufacture, and are said to be proceeding on a strictly cash basis.

Cincinnati

BUYER uncertainty became manifest in this area the past week, reducing the pace of machine tool bookings. With so many factors involved in the general market, manufacturers are not prone to advance any particular item as the cause of current recession. The fact, however, that foreign demand is almost stubbornly holding to current levels while the fluctuations offset domestic ordering only, tends to remove the war rumors as a suppressing factor, at least so far as first position is concerned. Small tools, the sensitive products in the machinery market, reacted most noticeably, although medium-size items also were off in demand. Requests for quotations are still active, however, and the trade reports no noticeable recession in inquiry.

Production is without change, since most plants are in possession of backlogs sufficient to carry through into the first quarter.

Pittsburgh

DESPITE the general tendency to delay commitments because of the current wave of caution, a fair volume of machine tool business continues to flow to local dealers. In some cases the rate of incoming orders is ahead of early September, and some projects being closed are of long standing. There has, however, been a moderate slowing up in new buying. This is not entirely due to recent business apprehension as some large consumers have already expended 1937 machine tool appropriations. Consequently, the resumption of buying on their part might not materialize before the end of this year when 1938 plans will have become known. Although steel business has declined, practically all steel producers are going ahead with previously planned programs as the industry usually takes a long term view. Current inquiries are a bit slower, but compare favorably with the corresponding September period. Factory deliveries on machine tools are a trifle easier, but there are a number of manufacturers who cannot make shipment in less than five months.

Chicago

ACTIVITY in most machine tool sales offices here in September was in excess of that recorded for August and in no case was less business reported. Although orders received thus far in October have not revealed a definite trend, sellers expect the month's bookings to surpass those of September. Deliveries, though still extended, are improved somewhat, and it is understood that some of the smaller builders are operating on a four-day week. In larger plants, however, two and three shifts are still being employed. Reports of a large inquiry from Russian interests are unsubstantiated in this district. Used machinery business is considerable, and many consumers, unable to wait the necessary period for delivery of some tools, have patronized second-hand sellers who can offer immediate shipment. Industrial lists are still few, and no railroad buying has been announced. Steel mill purchasing may be imminent, although not in a large amount.

Detroit

WHILE machinery inquiries and orders continue rather light, it has been reported that miscellaneous inquiries for presses of all sizes continue to come from automobile manufacturers who find it necessary to increase capacity. The delivery situation on these presses is quite extended, being over 14 weeks. While bids have been submitted for Ford's press building, there has as yet been no inquiry for equipment.

PLANT EXPANSION AND EQUIPMENT BUYING

NORTH ATLANTIC

Pan-American Airways System, 135 East Forty-second Street, New York, has taken out a permit for one-story motor shop at its terminal at Dinner Key Base, Miami, Fla., 100 x 180 ft., for reconditioning and repairs. Cost about $75,000 with equipment. Fred J. Gelhaus, Aviation Building, Cocoanut Grove, Fla., is company construction engineer in charge.

Linde Air Products Co., 30 East Forty-second Street, New York, has work under way on new plant at Tonawanda, N. Y., consisting of about 12 one and multi-story buildings, occupying close to eight acres. Cost about $1,500,000 with equipment. John W. Cowper Co., Sidway Building, Buffalo, is general contractor. Company also has taken over a two-story building at 729 North Pennsylvania Street, Indianapolis, now in course of erection, for new factory branch and distributing plant.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 19 for steel kingpost forging (Schedule 1830), 16,000 ft. of electric cable (Schedule 1871) for Brooklyn Navy Yard.

Wrought Iron Craftsmen, Inc., 131 West Twenty-fourth Street, New York, manufacturer of iron and metal specialties, has leased space in building at 46-52 East Eleventh Street for plant.

Columbian Carbon Co., 41 East Forty-second Street, New York, has plans for new carbon black plant near Corpus Christi, Tex., including large compressor station, power house, storage and distributing structures and other units. Plant will be connected by steel pipe line with casing head gasoline works of Southern Minerals Corp., about eight miles distant, for residue gas supply. Cost close to $400,000 with equipment. H. H. Reardon, Monroe, La., is general superintendent of company plants and will be in charge of project; H. J. Glaxon will be construction engineer on site.

Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, asks bids until Oct. 29 for 100,000 lin. ft. of one-conductor submarine mine cable (Circular 39); until Nov. 1, 191,400 ft. of wire, 34,600 ft. of cable and 35 reels (Circular 42).

Canada Dry Ginger Ale, Inc., 100 East Forty-second Street, New York, has asked bids on general contract for two one-story additions to factory branch, storage and distributing plant at Chelmsford, Mass., including improvements in two present buildings. Cost close to $110,000 with equipment. W. H. Corey, first noted address, is company engineer.

Westinghouse Electric Elevator Co., 1500 North Branch Avenue, Chicago, has taken over plant at A. B. See Elevator Co., Jersey City, N. J., recently acquired. Floor space will be increased about 50 per cent and additional equipment installed, including facilities for production of Westinghouse elevator units in addition to See elevators. Company will remove headquarters from Chicago to Jersey City at once.

Commanding Officer, Ordnance Department, Picatinny Arsenal, Dover, N. J., asks bids until Nov. 1 for 5000 aluminum fabrication fin assemblies for bombs, demolition type (Circular 234).

P. H. Gladfelter Co., Spring Grove, Pa., has let general contract to H. J. Williams Co., York, Pa., for one and multi-story additions to pulp and paper mill. Cost over $400,000 with equipment.

Delmarvia Brewing Co., Wilmington, Del., recently organized, has taken over former local plant of Bavarian Brewing Co., duPont Street, and will remodel for new plant, including installation of new equipment.

Barrett Coal Co., Jessup, Pa., plans rebuilding part of coal breaker plant recently destroyed by fire. Loss close to $25,000 with equipment.

BUFFALO DISTRICT

Morrison Steel Products, Inc., 127 Kehr Street, Buffalo, manufacturer of metal stampings, has let contract to R. S. McMannus Steel Construction Co., 1254 East Ferry Street, for structural steel for one-story addition. Cost close to $40,000 with equipment.

Board of Education, Central School District No. 4, West Valley, N. Y., Clifford B. West, clerk, asks bids until Oct. 18 for steel lockers.

Hambleton Terminal Corp., River Road, Tonawanda, N. Y., oil and gasoline products, has plans for addition for expansion in gasoline division, including cracking machinery and auxiliary equipment. Cost over $250,000.

WASHINGTON DIST.

Chemical Warfare Service, Edgewood Arsenal, Edgewood, Md., asks bids until Oct. 18 for pipe fittings (Circular 107); until Oct. 21 for galvanized pins with lead washers (Circular 109).

Virginia Airship Co., Richmond, Va., Garrett W. Peck, Grace Security Building, president, is considering new plant for manufacture of all-metal dirigibles, including parts production and assembling, to average about 400 ft. long and diesel engine-powered. Project will be carried out in conjunction with Interocean Dirigible Co., Richmond, with which first noted company is arranging a merger.

General Purchasing Officer, Panama Canal, Washington, asks bids until Oct. 19 for following equipment for school and college shops: Hand tools, spiral end mills, circular wood saws, sledge hammers, hand cold chisels, hedge shears, blacksmith's punches, spading forks, iron bench screws, screw clamps, 10,000 ft. of wire, 15,000 ft. of bare copper antenna wire and other equipment (Schedule 3293).

Public Buildings Branch, Treasury Department, Washington, plans extensions and improvements at Curtis Bay Coast Guard Depot, Curtis Bay, Baltimore, including modernizing metal-working and woodworking shops, cost about $88,000 with equipment; remodeling machine shop and foundry, including additional equipment, cost about $68,000; one-story addition to storage and distributing building, cost about $90,000 with equipment. Capt. Harvey S. Johnson is engineer-in-chief.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 19 for two vertical boring mills (Schedule 1832), one milling machine (Schedule 1841), one gasoline engine-driven portable arc welding set (Schedule 1846), one band metal-cutting saw (Schedule 1861), one turret type punching machine (Schedule 1862), one angling band ship saw, all motor driven (Schedule 1863) for Norfolk, Va., Navy Yard; wire rope and seizing strand (Schedule 1798); until Oct. 22, one electric bench grinder (Schedule 900-1146), two gasoline engine-driven industrial tractors (Schedule 1822) for Eastern and Western yards.

NEW ENGLAND

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 19 for one motor-driven hobbing machine for Newport, R. I., Navy Yard, Schedule 1848.

United Aircraft Corp., 400 South Main Street, East Hartford, Conn., has let general contract to R. G. Bent Co., 93 Edwards Street, Hartford, Conn., for two-story addition, 40 x 80 ft., primarily for a brake-testing department. Cost close to $45,000 with equipment. Albert Kahn, Inc., New Center Building, Detroit, is architect and engineer.

Readville Distilleries, Inc., 31 Milk Street, Boston, has let general contract to Samuel Rudnick, 154 Seaver Street, Roxbury, Mass., for two-story additions to plant at Hyde Park, 100 x 400 ft., and 100 x 200 ft., primarily for storage and distribution. Cost about $300,000 with equipment.

Sun Oil Co., 1608 Walnut Street, Philadelphia, has let general contract to Mauro Construction Co., Inc., Turks Head Building, Providence, R. I., for new bulk oil storage and distributing plant at Revere, Mass. Cost close to $75,000 with steel tanks, pumping machinery and other equipment.

SOUTH ATLANTIC

Thomson Coca-Cola Bottling Co., Thomson, Ga., has asked bids on general contract for one and two-story addition to mechanical-bottling plant, and one-story extension to service and garage building for company automobiles and trucks. Cost about $45,000 with equipment. Francis P. Smith, Norris Building, Atlanta, Ga., is architect.

D. B. Brazeal, Dawson, Ga., plans one-story works at Fourth Avenue and Pecan Street for manufacturer of motor trailers and motor skidders, latter for airplane service, including facilities for parts production and assembling. Cost over $45,000 with equipment. It is proposed to establish an airport at same location, with several field buildings.

SOUTH CENTRAL

Dixie Metal Products Co., 1000 North Twenty-eighth Street, Birmingham, manufacturer of metal cabinets and kindred products, has begun erection of new one-story plant at Bessemer, Ala., and will remove Birmingham works to that location where production will be concentrated for increased capacity. Cost close to $50,000 with machinery. Company is a unit of Bessemer Coal, Iron & Land Co., Bessemer.

Adams-Edgar Lumber Co., Morton, Miss., plans rebuilding machine shops, saw mill, power house and grading mill recently destroyed by fire, with loss of about $100,000 including equipment.

Pelican Cold Storage & Warehouse Co., Ltd., 1561 St. Louis Street, New Orleans, has purchased four one and multi-story buildings at Benville, Clay and North Front Streets, including main 12-story structure, and will remodel for new terminal. Cost about $85,000 with conveying, loading, elevating and other mechanical-handling equipment.

Koelling Bottling Co., Clarksdale, Miss., has acquired former plant of Coca-Cola Bottling Co., and will remodel for new mechanical-bottling works, including new equipment. Cost close to $40,000 with machinery.

SOUTHWEST

Marley Co., 1915 Walnut Street, Kansas City, Mo., manufacturer of water towers and other water-cooling equipment, has acquired tract on Fairfax Road for new two-story plant, with main floor 180 x 180 ft., and second story, 40 x 180 ft. Bids will be asked soon on general contract. Keene & Simpson, Land Bank Building, are architects.

Monsanto Chemical Co., 1700 South Second Street, St. Louis, has let general contract to Fruin-Colnon Contracting Co., Merchants Laclede Building, for one-story

addition, 60 x 160 ft., primarily for storage and distribution. Cost about $45,000 with equipment.

Continental Oil Co., Ponca City, Okla., plans new pumping plant for oil pipe line service at Susank, Kan. Cost close to $40,000 with equipment. David Clark is superintendent in charge.

Board of Education, Galveston, Tex., plans manual training shops in new three-story junior high school, 200 x 240 ft., for which bids will be asked soon on general contract. Cost about $500,000. Financing has been arranged through Federal aid. Benjamin Milam, 2115 F Street, is architect.

Pontiac Refining Corp., Nixon Building Corpus Christi, Tex., plans new oil refinery on ship channel, comprising several one and multi-story buildings. Steel tank storage facilities will be provided for initial capacity of about 235,000 bbl. Cost close to $125,000. Mid-Continent Engineering Co., First National Bank Building, Dallas, Tex., is engineer in charge.

WESTERN PA. DIST.

Erie Brewing Co., 2131 State Street, Erie, Pa., has let general contract to Upton Lang Co., 1009 Commerce Street, for one-story and basement mechanical-bottling works. Cost close to $45,000 with machinery.

Briar Hill Coal Co., East Butler, Pa., plans rebuilding coal tipple recently destroyed by fire, including conveyor and accessories. Loss close to $35,000 with machinery.

Taylor, Smith & Taylor Co., Chester, W. Va., will soon let general contract for addition to pottery, including kiln unit, conveyors and other mechanical-handling equipment. Plant capacity will be increased about 25 per cent. Cost about $100,000 with machinery.

OHIO AND INDIANA

International Harvester Co., 606 South Michigan Avenue, Chicago, Motor Truck Division, has plans for two-story addition to branch plant at Springfield, Ohio, totaling about 110,000 sq. ft. of floor space. One floor will be used for production of motor pick-up bodies and cowls, and other floor primarily for storage and distribution. Cost close to $700,000 with equipment.

Brewing Corp. of America, Inc., Quincy and East Ninety-third Streets, Cleveland, has let general contract to Sam W. Emerson Co., 1836 Euclid Avenue, for two additions, comprising main four-story unit, 60 x 136 ft., for fermentation department, storage and distribution, and another smaller unit for expansion in mechanical-bottling division. Cost about $180,000 with equipment. Ernest McGeorge, 1900 Euclid Avenue, is architect and engineer.

Cimatool Co., 1517 East Third Street, Dayton, Ohio, manufacturer of tools, dies, special machinery and parts, has plans for new one and two-story works, 200 x 380 ft. Cost over $150,000 with equipment. J. Douglas Lorenz, 330 West First Street, is architect.

Contracting Officer, Materiel Division, Army Air Corps, Wright Field, Dayton, Ohio, asks bids until Oct. 18 for one portable electric drum elevator, six oil house drum racks and one rack oil storage room drum (Circular 244); until Oct. 19, 87 dial type, reversible test indicators (Circular 250), 16 inertia starter, yielding clutch energizer assemblies (Circular 283); until Oct. 20, 75 landing gear, retractable type signal assemblies (Circular 293); until Oct. 21, four vacuum pump and motor assemblies (Circular 284); until Oct. 22, camera filter adapter assemblies, camera support arms, gun camera film indicator lamp cap bases, gun camera bearings, camera support brackets, cable assemblies, screws, springs, keys, etc. (Circular 288); until Oct. 25, for lamp holder adapters, plug bases, outlet boxes, bushings, plug caps, lamp socket caps, pipe straps, lamp guards, etc. (Circular 299).

General Electric Co., Decatur, Ind., has asked bids for three one-story additions, for expansion in assembling department, loading division, storage and distributing department. Cost over $100,000 with equipment. E. W. Lankenau is local manager.

MICHIGAN DISTRICT

Chrysler Corp., 341 Massachusetts Avenue, Detroit, has approved plans for additions to branch plant at Windsor, Ont., operated in name of Chrysler Corp. of Canada, Ltd., comprising one and multi-story units for expansion in parts, assembling and other departments. Cost close to $3,500,000 with equipment.

Signal Electric Mfg. Co., Broadway, Menominee, Mich., has plans for two-story addition, 57 x 130 ft., in part for storage and distribution, for which foundation contract has been let to John Selen & Son, 1109 Michigan Avenue, and award for superstructure will be made soon. Cost over $45,000 with equipment. Derrick Hubert, 1065 Sheridan Road, is architect.

Briggs Mfg. Co., 11631 Mack Avenue, Detroit, steel automobile bodies, has let general contract to W. E. Wood Building & Construction Co., Highland and Third Avenues, for one-story units for new plant on 74-acre tract on Eight-Mile Road, for production of automobile body parts, rolled steel moldings and kindred specialties. Cost about $2,500,000 with equipment.

MIDDLE WEST

Central Scientific Co., 1700 West Irving Park Boulevard, Chicago, manufacturer of scientific instruments and parts, has let general contract to A. E. Nelson & Son, 2432 Irving Park Boulevard, for one-story and basement addition, 50 x 118 ft., part of unit to be used for production and remainder for storage and distribution. Cost about $60,000 with equipment. J. Lyle Kincaid is company engineer in charge.

Kraft-Phenix Cheese Corp., 400 Rush Street, Chicago, has let general contract to George A. Fuller Co., 111 West Washington Street, for nine and five-story and basement plant at 420-60 East Illinois Street, 123 x 218 ft., and 85 x 271 ft., respectively. Cost about $1,500,000 with equipment. Mundie, Jensen, Bourke & Haven, 39 South LaSalle Street, are architects.

Milwaukee Railroad, Milwaukee Depot, Minneapolis, Minn., has let general contract to James Leck Co., 211 South Eleventh Street, for extensions and improvements in engine house and shops at South Minneapolis yards, including new 110-ft. steel turntable. Cost about $100,000 with equipment.

Town Council, Greenfield, Iowa, C. L. Downing, town clerk, asks bids until Oct. 25 for diesel engine-generator unit for municipal electric plant, including hoist and trolley, fuel oil day tank, starting air tanks, feed pumps, oil filters and coolers, and accessory equipment.

United States Engineer Office, Fort Peck, Mont., asks bids until Oct. 18 for two motor-driven air compressors (Circular 120).

Automatic Spring Coiling Co., 3982 West Barry Avenue, Chicago, manufacturer of steel springs, coil springs, etc., will ask bids soon on general contract for one-story plant unit. Cost close to $50,000 with equipment. M. F. Strauch, 2216 West Giddings Street, is architect.

Town Council, Primghar, Iowa, asks bids until Nov. 2 for engine-generator unit and accessory equipment for municipal electric power plant; also for an electrical distributing system. Cost close to $400,000. Buell & Winter Engineering Co., Insurance Exchange Building, Sioux City, Iowa, is consulting engineer.

Le Roi Co., 1706 South Sixty-eighth Street, Milwaukee, manufacturer of truck, tractor and industrial engines, has leased 25,000 sq. ft. in Factory Arcade building, adjoining its main plant, to accommodate assembly of large air compressors, releasing nearly same amount of space for general production in own plant. Some new equipment is being purchased.

Globe-Union, Inc., 900 East Keefe Avenue, Milwaukee, manufacturer of storage batteries, radio parts, spark plugs, roller skates, etc., is moving its branch factory at Seattle, Wash., into new building, 100 x 175 ft., increasing capacity to 500 batteries daily.

Endres Mfg. Co., Milwaukee, manufacturer of steel burial vaults, has leased 22,000 sq. ft. of space in factory building at 4200 West Monarch Place, and will increase its capacity by fully 100 per cent.

George A. Whiting Paper Co., 100 River Street, Menasha, Wis., has placed general contract with Fluor Brothers Construction Co., 48 Otter Street, Oshkosh, Wis., for boiler house additions, 48 x 26 and 47 x 21 ft., costing about $75,000 with equipment. Orbison & Orbison, Appleton, Wis., are consulting engineers.

Mining Journal Co., Ltd., Marquette, Mich., publisher of Marquette Daily Mining Journal, has acquired site at 118 North Front Street, for proposed new publishing plant. Preliminary plans are in progress.

Whitnall Conveyor Co., Whitewater, Wis., has purchased roller rink building and will remodel into manufacturing plant. Present factory will be occupied by Auto Products Co., Cedarburg, Wis., manufacturer of hub caps and other automotive replacement parts.

Milwaukee Department of Public Works, City Hall, closes bids Oct. 26 for one 30,000,000-gal. daily capacity, motor-driven centrifugal pump in Menomonee Valley booster station of municipal waterworks system. R. E. Stoelting is commissioner.

PACIFIC COAST

San Diego Standard Electric Corp., San Diego, Cal., electrical equipment and supplies, has plans for one-story storage and distributing plant, 100 x 100 ft. Cost about $70,000 with equipment. Loring & Co., 3702 India Street, are architects.

Porterville Union High School District, Porterville, Cal., will install a manual training department in new high school, for which bids will be asked soon on general contract. Cost $154,000. Financing has been arranged through Federal aid. W. D. Coates, Rowell Building, Fresno, Cal., is architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 19 for two motor-driven ram-type turret lathes (Schedule 1799) for Puget Sound Navy Yard, and for seamless copper tubing (Schedule 1834) for Puget Sound and other navy yards.

Amalgamated Sugar Co., Ogden, Utah, has plans for new beet sugar mill at Nyssa, Ore., consisting of one and multi-story units, storage and distributing buildings, power house, pumping station, machine shop and other structures. Cost close to $1,750,000.

Saticoy Lemon Association, Montalvo, Cal., has asked bids on general contract for two-story and basement addition to citrus fruit packing plant, 154 x 210 ft., primarily for storage and distribution. Cost close to $100,000 with conveyors, loaders and other mechanical equipment. Roy C. Wilson and G. N. Lawford, Say Road, Santa Paula, Cal., are architects.

United States Engineer Office, Bonneville, Ore., asks bids until Oct. 29 for mechanical gate control equipment (Circular 132).

Puget Sound Pulp & Timber Co., Bellingham, Wash., has plans for new steam power house at branch sulphite pulp mill at Anacortes, Wash. Cost about $250,000 with boiler units, pumps and other equipment. H. P. McCurdy, 2929 Sixteenth Avenue, S.W., Seattle, is consulting engineer.

Berkeley Unified School District, Berkeley, Cal., has plans for new one-story vocational shop building at Grove and Kittredge Streets. Cost about $150,000 with equipment. Will G. Corlett, Bank of America Building, Oakland, Cal., and H. H. Gutterson, 526 Powell Street, San Francisco, are architects.

FOREIGN

Armco (Australia) Pty., Ltd., Temple Court, Melbourne, Australia, plans new plant at Sydney, New South Wales, Australia, in conjunction with steel works of John Lysagt (Australia) Pty., Ltd., at that place, for production of steel sheets. Cost close to $5,000,000 with equipment. Company is a subsidiary of American Rolling Mill Co., Middletown, Ohio.

British Aluminum Co., Ltd., London, England, operating mills at Warrington and Argyll, England, plans new works at Newport, Wales, with power house, machine shops and other structures. Cost close to $750,000 with machinery.

Steel Ingot Output Off 12%; Nine Months Total 42,498,769 Tons

ALTHOUGH steel ingot output in September dropped 12 per cent below that of August according to figures gathered by the American Iron and Steel Institute, the total for the first nine months of this year was 42,498,769 gross tons, only 4,309,011 tons below the total for the entire year 1936 and only 2 per cent below that of the corresponding period in 1929, steel's record-breaking year. The total for the first nine months of 1929 was 43,353,830 tons.

The September output was 4,301,869 tons of open-hearth and bessemer ingots compared with 4,875,671 tons in August. The August figures in the accompanying table have been revised by the institute. The operating rate in September was 76.52 per cent, which was the lowest of the year excepting June, when production was curtailed by strikes. In September, 1936, output was 4,151,388 tons, or 74.05 per cent of the then existing capacity.

The average rate of operations for the first nine months of this year was 83.12 per cent against 65.40 per cent during the corresponding period of 1936 and 95.03 per cent in 1929.

If operations during the fourth quarter should average 70 per cent of the industry's capacity, the total for the year would be about 54,580,250 tons, which would just eclipse the 1929 record of 54,312,279 tons. However, if the fourth quarter average should fall much below 70 per cent, 1929 will still stand as the all-time record.

PRODUCTION OF OPEN-HEARTH AND BESSEMER STEEL INGOTS

(Reported by Companies Which in 1936 Made 98.29 Per Cent of the Open-Hearth and 100 Per Cent of the Bessemer Ingot Production)

	Reported Production (Gross Tons)		Calculated Production All Companies		Number of	Per Cent of Ca-
1936	Open-Hearth	Bessemer	Monthly	Weekly	Weeks	pacity
January	2,794,766	196,389	3,039,804	686,186	4.43	52.39
February	2,707,320	202,445	2,956,891	714,225	4.14	54.53
March	3,094,939	185,040	3,333,853	752,563	4.43	57.46
1st Quarter	8,597,025	583,874	9,330,548	717,734	13.00	54.80
April	3,565,761	304,775	3,932,605	914,593	4.29	69.99
May	3,671,375	302,092	4,037,375	911,371	4.43	69.58
June	3,578,383	334,897	3,975,569	926,706	4.29	70.75
2nd Quarter	10,815,519	941,764	11,945,549	918,182	13.01	70.10
1st 6 Months	19,412,544	1,525,638	21,276,097	817,997	26.01	62.45
July	3,526,380	326,606	3,914,370	885,604	4.42	67.61
August	3,768,135	350,560	4,184,287	944,534	4.43	72.11
September	3,782,498	303,048	4,151,388	969,950	4.28	74.05
3rd Quarter	11,077,013	980,214	12,250,045	932,981	13.13	71.23
1st 9 Months	30,489,557	2,505,852	33,526,142	856,570	39.14	65.40
October	4,144,395	317,710	4,534,246	1,023,532	4.43	78.15
November	3,925,146	329,553	4,323,025	1,007,698	4.29	76.94
December	4,048,552	305,342	4,424,367	1,000,988	4.42	76.42
4th Quarter	12,118,093	952,605	13,281,638	1,010,779	13.14	77.17
Total Year	42,607,650	3,458,457	46,807,780	895,329	52.28	68.36
1937						
January	4,357,338	291,794	4,724,939	1,066,578	4.43	81.43
February	4,012,358	331,669	4,413,832	1,103,458	4.00	84.25
March	4,730,579	403,787	5,216,666	1,177,577	4.43	89.91
1st Quarter	13,100,275	1,027,250	14,355,437	1,116,286	12.86	85.23
April	4,601,620	390,198	5,071,875	1,182,255	4.29	90.27
May	4,685,749	386,290	5,153,559	1,163,332	4.43	88.82
June	3,832,514	284,572	4,183,762	975,236	4.29	74.46
2nd Quarter	13,119,883	1,061,060	14,409,196	1,107,548	13.01	84.56
1st 6 Months	26,220,158	2,088,310	28,764,633	1,111,891	25.87	84.39
July	4,148,389	336,035	4,556,596	1,030,904	4.42	78.49
August	*4,425,255	373,428	*4,875,671	*1,100,603	4.43	*83.79
September	3,961,009	271,948	4,301,869	1,005,110	4.28	76.52
3rd Quarter	12,534,653	981,411	13,734,136	1,046,012	13.13	79.64
1st 9 Months	38,754,811	3,069,721	42,498,769	1,089,712	39.00	83.12

*Revised.

Houston Pipe Line Co., Petroleum Building, Houston, Tex., plans new 6-in. welded steel pipe line on Center Street, Deer Park district, connecting with main line of Shell Pipe Line Co., about 10,800 ft., in all, for natural gas transmission.

Southern Natural Gas Co., Yazoo City, Miss., with executive offices at 90 Broad Street, New York, has authorized four 10-in. welded steel pipe lines across Mississippi River, near Yazoo City, for natural gas transmission. Work will be in charge of Ford, Bacon & Davis, Inc., 39 Broadway, New York, engineer. Award for electric welding has been made to H. C. Price Co., Bartlesville, Okla.

State Refining Co., Grand Rapids, Mich., has authorized new 3-in. welded steel pipe line from oil field in Salem Township, Allegan County, to Hudsonville, Mich., about nine miles, for crude oil transmission to terminal plant at last noted place. Later company plans extensions in line to point near Grand Rapids, where new refinery will be built.

Oregon City, Ore., plans about nine miles of 2 to 6-in. steel pipe for water line. Fund of $32,727 has been secured through Federal aid for this and reservoir. C. E. Carter, 1735 N.E. Forty-seventh Street, Portland, is engineer.

Petrol Corp., 4020 Bandini Boulevard, Los Angeles, plans new welded steel pipe line from Gato Ridge oil field, Santa Barbara County, to new marine terminal to be located about three miles from Point Sal, and known as Port Petrol, Cal., about 23 miles, for crude oil transmission. Booster pumping stations will be installed along route. Company will build bulk storage and distributing plant at terminus noted, with facilities for loading a fleet of tankers. Entire project will cost over $400,000.

Citizens Gas Co., McCook, Neb., plans welded steel pipe line to connect with main pipe line of Kansas Pipeline & Gas Co., for natural gas transmission for local distribution. Citizens company is a subsidiary of Central States Electric Co., Cedar Rapids, Iowa.

M-A-R Pipe Line Corp., 701 Furman Street, Corpus Christi, Tex., has let contract to J. W. France, 3222 Lawrence Drive, for 6 to 8-in. welded steel pipe line from Saxet oil field to terminal of Export Oil Storage Co., Corpus Christi, about 16½ miles, for crude oil transmission to latter point. Pumping stations will be installed along route for booster service. Cost over $100,000.

Gulf Pipe Line Co., Houston, Tex., a subsidiary of Gulf Oil Corp., same address, plans 2½-in. welded steel pipe line under and across Bayou Lafourche, Lafourche Parish, La., for natural gas transmission.

John W. Schmidt, Anoka, Minn., plans steel pipe line system for natural gas distribution at Wolf Point, Mont., where franchise has been granted.

IN QUARANTINE *for You—*

NO immigrants anywhere ever get a more searching examination than the materials ordered for Crane ves and fittings.

Though bought from the most reli- le sources according to rigidly tested cifications, every shipment of mate- l goes into "quarantine" at the Crane nts. There it stays until thoroughly ted in Crane laboratories.

This careful testing means that Crane bsolutely certain that materials are ht before manufacture begins. It is y part of the elaborate system of ts and checks of tests throughout ry Crane plant.

or after raw materials have been made into castings, the castings are checked and tested at every step through the various sub-assemblies, every part of a Crane product is tested, dimensions gauged and inspected. Finally, the finished valve or fitting is inspected as a whole before it leaves the plant.

There are over 33,000 gauges used in making certain that the dimensions of Crane valves and fittings are absolutely accurate. There is an army of inspectors whose only duty is to see that every Crane product is right in every part. Back of all this effort are the largest laboratories in the industry devoted to seeing that present products are properly made as well as working on new products for the future.

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VES, FITTINGS, FABRICATED PIPE, PUMPS, PLUMBING AND HEATING MATERIAL

plied in the next few days.

STORM WARNINGS FOR STEEL PLANTS

PITTSBURGH, Pa., Sept. 28—Winter storms and cold waves can raise havoc around a steel plant. Long pipe lines, huge mills, many services, all combine to make piping maintenance a problem from the first frost to the last.

It's cheaper to go over your lines while good weather lasts. Replace weakened valves, fittings or lengths of pipe. Get everything shipshape before numbed hands, binding ice and clogging snow delay repairs and increase their cost.

Make your Crane No. 52 Catalog your guide to longer service, fewer breakdowns, less maintenance cost as you plan your campaign against winter. Within its pages you will find a world of valves, fittings and piping that are "tops" in quality, dependability and efficiency. CranEquip your mills and power plants now. That is the way to piping satisfaction.

. . TRADE NOTES . .

Robinson Welding Supply Co., supplying welding machines, electrodes and accessories, has been established by J. M. Robinson, Detroit, district manager since 1925 for the Lincoln Electric Co. Lincoln products will be handled by the new company which will be located at 1921 E. Ferry Street, Detroit.

Beckley Perforating Co., Garwood, N. J., has developed and built a special perforating press for perforating large moving picture sound screens in one piece. On this new type perforating press, screens as large as 18 ft. x 24 ft. can be perforated in a single piece, eliminating all sewed seams and adding to the quality of the screen and beauty of the picture.

Kron Co., Bridgeport, Conn., has appointed the J. A. Hunt Co., 2036 Sansom Street, Philadelphia, as district representative.

Hammond Machinery Builders, Kalamazoo, Mich., have appointed the B & H Sales Co., 4980 Potomac Street, St. Louis, as their representative in that city.

Wailes Dove-Hermiston Corp., New York, has appointed the following distributers; Air Associates, Inc., Garden City, N. Y.; Curry Brothers Oil Co., Boston; Kasper & Koetzle, Inc., Brooklyn, and Read & Lundy, Inc., Providence.

Babcock & Wilcox Tube Co., Beaver Falls, Pa., has made Clowe & Cowan, Inc., Amarillo and Lubbock, Tex., distributer for its products in the Texas Panhandle, South Plains and eastern New Mexico.

Synthetic Resin Manufacturers Association has appointed Foster D. Snell, Inc., New York, consulting chemist and chemical engineer, to act as the official laboratory of that association.

American Commercial Steel Co., distributer of steel products, has moved its offices and warehouse from Brooklyn to 36-33 Van Alst Avenue, Long Island City, N. Y.

Linde Air Products Co., New York, has moved its Boston district office to 441 Stuart Street.

Berger Mfg. Co., St. Louis, has leased a three-story warehouse, with 40,000 sq. ft. of floor space, at 1431 North Second Street, where it will carry a complete line of Berloy blue label sheet metal building products. Horace A. Williams is warehouse manager.

G. S. Blakeslee & Co., manufacturers of degreasing machines and metal parts washers, have started construction of a two-story addition to their present plant at 19th Street and 52nd Avenue, Cicero, Ill., which will give a 50 per cent increase in present manufacturing space.

Lincoln Electric Co., Cleveland, has appointed W. R. Persons manager of its Pittsburgh welding sales-engineering office. Mr. Persons, who has been working in the Pittsburgh office since 1934, will be assisted by J. H. Painter, M. S. Schonvizner, R. H. Schuster and H. E. White.

George H. Soule Co., St. Albans, Vt., has been named a distributer of Armco Ingot Iron by the American Rolling Mill Co., Middletown, Ohio.

Linde Air Products Co., New York, has contracted for occupancy of a new two-story office building at 729 North Pennsylvania Street, Indianapolis. Building will be ready on or about Nov. 1, when the present Linde office, located at the Prest-O-Lite Co. Speedway plant outside Indianapolis, will be transferred to the new location.

Cellophane is being used instead of glass for windows in an effort to lighten 30 stainless steel cable cars being made for use in the Italian Alps by Piaggio & Co., of Genoa, Italy, a licensee of the Edward G. Budd Mfg. Co., of Philadelphia. Fifty stainless railway cars are also being built by the Italian firm.

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INDUSTRIAL, ARCHITECTURAL, DECORATIVE
Industrial Screens for all purposes.
Cane and Machinery Guards.
Grilles to meet all requirements for heating.
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DIAMOND has a national reputation for perforated metal products of the better quality.
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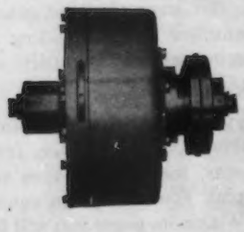
Sales Representatives in all principal cities.

Dings—
The Mill Type Magnetic Clutch

The Dings Magnetic Clutch is 30% heavier than the ordinary clutch. The hubs are of high quality steel far superior to cast iron hubs. Friction surfaces are larger for better wearing and are provided with a perfect means for adjustment. Capscrews are locked tight and cannot work loose. Through and through it is a Mill Type Magnetic Clutch—simple, rugged, tough!

Dings has the answer to clutch problems in Dings Magnetic Clutches. They are lightning quick yet give easy gentle engagement with a running motor. They can be arranged for remote control either automatic or manual or for any pre-set cycle. They can be adjusted to slip or dis-engage at any pre-set torque.



Designs provide for any horsepower transmission and straight lift, and back of them is nearly 40 years of experience in developing and building magnetic equipment.

Why not let our engineers help you?

Dings Magnetic Separator Co.
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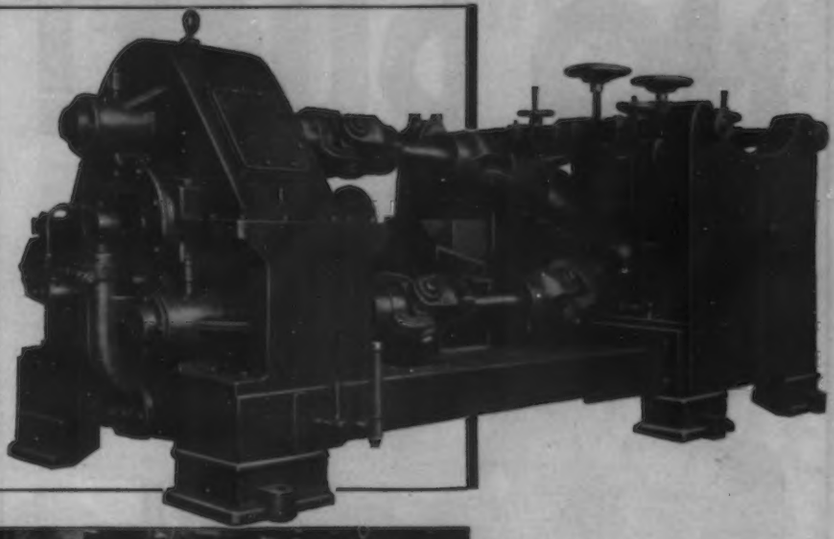
STRAIGHTENING AND TURNING MACHINES



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Greater speed and greater capacity has been built into the newly designed Medart Continuous Automatic Straightening and Polishing Machines...Rolls are mounted in Timken-matched units...Improved anti-backlash Universal Joints result in more efficient operation during the polishing and straightening of round, drawn and turned bars...Rolls are made of highest grade alloy tool steel, properly heat treated and tempered. Built in all sizes.

★

The Medart Turning Machine is a continuous feed, no-gap-between-bars type of high-production, heavy-duty machine. The bars or tubes are automatically fed into two rotating cutter heads by a pair of feed rolls and two sets of grip jaws. The discharge carriage, outgoing clamp and carriage return are all either automatic or mechanical. The machines may be used for precision turning or bar or tube peeling. Built in all sizes.

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Engineering Sales Offices: Cincinnati, Cleveland, New York, Buffalo, Philadelphia, Chicago, Pittsburgh, New Orleans, Charlotte, San Francisco, Los Angeles, Dallas, Denver, Birmingham, Milwaukee, Minneapolis, Atlanta, Detroit, Grand Rapids, Kansas City

Skoda Works Now Enjoying Prosperity

LONDON *(Special Correspondence)*.—One of the most flourishing of the big central European steel and armament plants is the Skoda works of Czechoslovakia.

About 10 years ago Britain came to the aid of this undertaking with a loan of several million pounds to help it to develop its export trade. As a result, in the last four years the dividend on Skoda's capital has come up from nil to nearly 20 per cent. The company's export business last year was 40 per cent ahead of 1935, and shows a further substantial increase this year.

British and French interest in the concern is represented by £3,300,000 ($16,500,000) 6 per cent sterling debentures, this being the outstanding amount of the original £5,000,000 ($25,000,000) issue. French industrialists also hold a substantial block of the share capital.

The Skoda enterprise is now enjoying such prosperity that the directors are said to be considering the time when they can repay the British loan. A transaction of this sort, however, cannot be carried out so long as Czechoslovakia maintains her present exchange restrictions.

High Tungsten Steel Prices in Britain

LONDON (*Special Correspondence*).—The price of high-speed tungsten steel containing 18 per cent tungsten has been raised again in the United Kingdom by 1s. to 5s. per lb. This is a direct result of the recent rise in wolfram following on the cutting-off of supplies from China. Wolfram now stands at about 125s. ($31.25) per unit.

The price of pure tungsten now stands at about 10s. ($2.50) per lb., and manufacturers even at this price are finding difficulty in covering their forward requirements as freely as they would wish. As much as 1s. 9d. (42c.) per lb. is being paid for scrap high-speed steel of 18 per cent tungsten content.

Engine Wheels Wear Rails in Brazil

BECAUSE the steel in the wheels of the new electrified trains of the Central of Brazil Railway is much harder than that of the present rails, the rails are wearing rapidly, A. W. Childs, acting American commercial attache, Rio de Janeiro, who recently had occasion to observe the equipment, reported to the Department of Commerce.

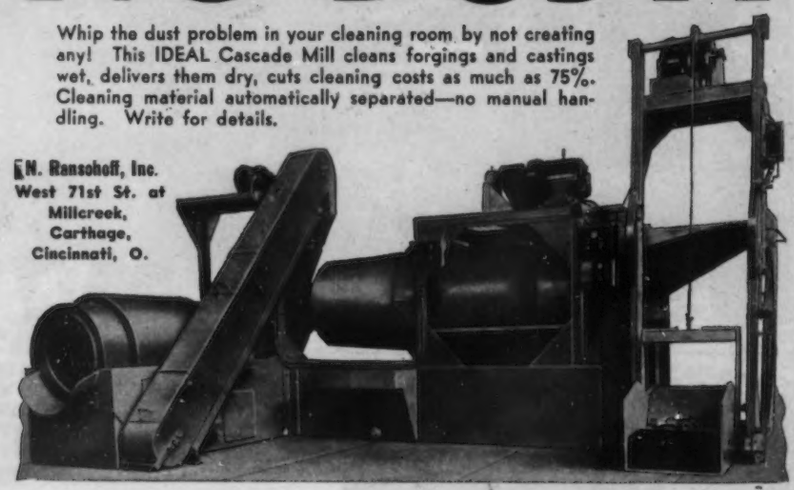
It was observed that all along the electrified line, which has been in operation only a short time, there was a noticeable quantity of steel dust which had been ground from the rails. On certain curves where the wear is greater, actual rail shavings of some size were found, Mr. Childs reported.

The excessive wear is thought to be due to the difference in hardness of rail and the train wheels, with the length of cars, sharp curves, and other factors contributing to the wear of the rails, the report states.

There is apparently no doubt that many of the rails in use at the present time on the electrified sections of the Central Railway will be replaced and there is a possibility of an opportunity for American manufacturers to furnish such replacements, according to the report.

NO DUST!

Whip the dust problem in your cleaning room by not creating any! This IDEAL Cascade Mill cleans forgings and castings wet, delivers them dry, cuts cleaning costs as much as 75%. Cleaning material automatically separated—no manual handling. Write for details.



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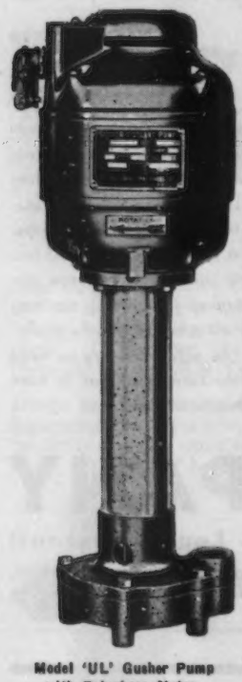

Model 'UL' Gusher Pump with Polyphase Motor.

"GUSHER" COOLANT PUMPS

require no stuffing boxes. Hence, the need for repacking and readjustment is eliminated. Friction is also cut down considerably, and the full advantage of their fine ball-bearing construction is realized day in and day out.

THE RUTHMAN MACHINERY COMPANY
537 EAST FRONT ST., CINCINNATI, OHIO

THIS SAVING OF 36% shows up in BIGGER SALES AND PROFITS!

These flanged yokes are held to close limits (±.001" on the outside rim and on the reamed hole). Both operations are now performed at the same time which was impossible on the equipment formerly used.

GISHOLT TURRET LATHES

Sizes range from 1" to 12" bar capacity—up to 34" chucking capacity

● Here's another concrete case where modern Gisholt equipment cuts a large slice out of production costs and the savings are reflected as greater sales and profits! By installing a new Gisholt 1L High Production Turret Lathe, this well-known manufacturer combined on one machine, the work formerly done on two other lathes. Equipped with modern Gisholt Standard Tools, the new Gisholt greatly reduced machining time—cut the cost of producing 5,000 each of four different parts from $3,005 to $1,907—*a saving of $1098 or 36%.*

These features, combined only in Gisholt Turret Lathes, are responsible for this saving

★ Heavy, rigid machine construction permits higher cutting speeds and multiple cuts with greater precision and accuracy.

★ 12 speed transmission with double-multiple disc clutch for starting and reversing—saves time with direct shifting from forward to reverse.

★ Automatic spindle brake stops the spindle quickly without loss of time—provides faster positioning of fixture for removing or chucking new parts in the machine.

★ Power rapid traverse to the tool post carriage (in both directions—cross and longitudinal) quickly brings the cutting tools into position with a minimum loss of time and without physical effort.

★ Power rapid traverse to the hexagon turret carriage—both forward and backward.

★ Quick indexing and clamping of the square turret tool post saves time in carrying through a cycle of operations.

★ Easier, faster operation with simple controls and less effort on the part of the operator.

SEND FOR THIS NEW CATALOG OF SMALL TOOLS

Keep in step with the new improvements that shorten set-up and machining time. Write for your copy of the new Gisholt Catalog of Standard Tools for Nos. 3, 4 and 5 Ram Type Universal Turret Lathes.

Now is the time to tool up for reducing manufacturing cost. Why not get full information on these new Gisholts? Write us today.

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TURRET LATHES • AUTOMATIC LATHES • TOOL GRINDERS • BALANCING MACHINES

Steel Workers Above 600,000 in August

MORE than 603,000 employees were on the payrolls of the steel industry during August, according to a report issued by the American Iron and Steel Institute. A total of 594,000 was employed in July.

The increase reflects the fact that steel operations in August, averaging 83.6 per cent of capacity, were higher than in July when operations were at 78.5 per cent. In September, the industry operated at about 75 per cent of capacity, according to preliminary reports.

Payrolls of the industry in August amounted to $92,663,000, which compares with $90,550,000 in July. In August, 1936, 522,000 were employed in the industry and payrolls totaled $66,338,000, indicating an increase in one year of 16 per cent in the number of employees and 40 per cent in monthly payrolls. Over the same period the volume of steel output increased 16 per cent.

Of the total number of steel employees in August, 541,000 were wage earning employees receiving hourly, piecework or tonnage wages. Hourly earnings of this group averaged 86.1c. per hr. during the month, as against 86.8c. in July and 66.8c. in August of last year.

Wage earners worked an average of 37.9 hr. per week in August, compared with 37.3 hr. in July and 39.7 hr. in August, 1936.

Employment and payroll data of the steel industry for the months of July and August, 1937, and August, 1936, are compared in the following table:

	Aug., 1937	July, 1937	Aug., 1936
Total number employed	603,000	594,000	522,000
Total payrolls	$92,663,000	$90,550,000	$66,338,000
Average hourly earnings, wage earners	86.1c.	86.8c.	66.8c.
Average hours per week, wage earners	37.9	37.3	39.7

Farm Machinery Exports Double

WASHINGTON, Oct. 8.—United States exports of agricultural implements and machinery during August were valued at $7,533,005, a 96 per cent gain above August a year ago when $3,845,581 worth was shipped abroad, according to the Machinery Division of the Department of Commerce. Increased sales were made particularly in tractors and cultivating implements.

The August foreign sales were slightly lower, seasonally, than in July, but the total for the first eight months of this year, amounting to $50,224,175, was 73 per cent greater than the corresponding January-August figure for last year of $29,036,811, and 14 per cent above the exports during the entire year 1936 valued at $43,993,899.

August exports of tractors and parts were valued at $5,387,340, 124 per cent above the comparable shipments last year amounting to $2,400,528. Wheel tractor sales abroad registered a gain of 149 per cent, totaling $2,412,001 compared with $974,479 during August 1936.

Pittsburgh Payrolls Above 1929 Level

PAYROLLS in the Pittsburgh area for the past four months have ranged from 1 to 2 per cent above the average month of 1929, while the cost of living has been between 12 and 15 per cent lower in the first half of this year than in 1929, according to data compiled by the Bureau of Business Research of the University of Pittsburgh. The number of workers employed in the past four months was approximately the same as in the average month of 1929.

Although factory employment declined 0.5 per cent and payrolls fell 0.7 per cent from July to August, approximately 17 per cent more people were employed in Pittsburgh in August than in the same month last year, the bureau stated.

Flood Control Work Is Near

THE first major contract in a $27,000,000 flood control program in southern New York may be undertaken before spring with Federal funds for building two dams at Arkport and Whitney Point already allotted and engineering plans prepared, according to U. S. Army engineers. Final approval of the projects has been delayed by an executive order requiring State or local authorities to furnish to the Government a clear title to all necessary lands.

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COMPLETE control of all processing from selection of the melting charge to the finished condition is the N. F. & O. *guarantee of quality* in forgings furnished to your specifications—Smooth Forged, Hollow Bored, Rough or Finished Machined.

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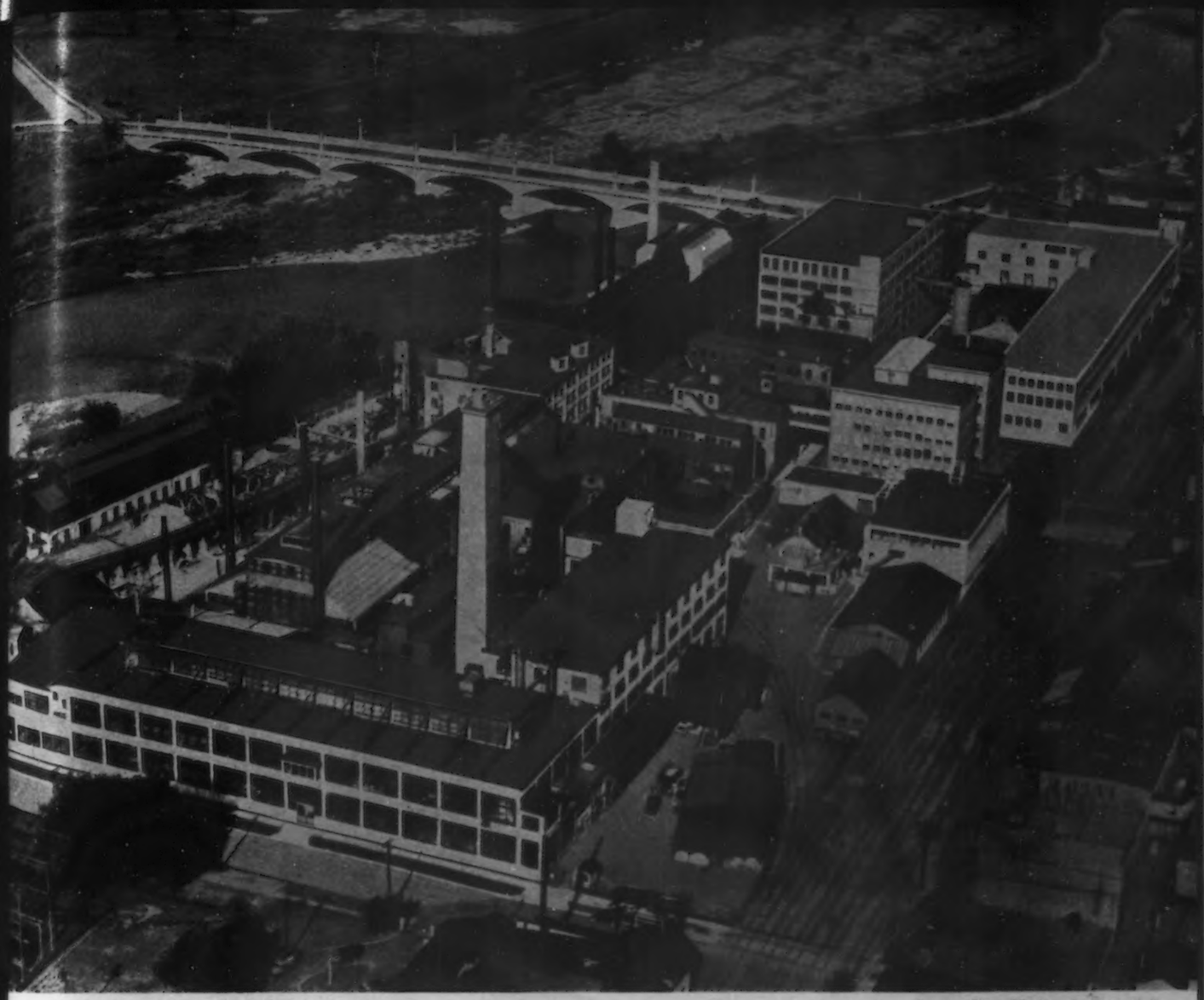
IRVINE, WARREN COUNTY, PENNA., U. S. A.



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The Owners of this great plant have given us eleven Repeat Order Contracts

FACTORY MANAGERS who have tried the older methods of buying factories, or additions, are urged to try our newer way, which is time tested by twenty years of Repeat Orders.

We design, build and often equip factories, complete with all machinery, and ready to run. So far this year we have had thirty-one Repeat Order Contracts totaling $7,919,731.30.

Our work is done by one organization, with one responsibility, one price and one profit.

Price, delivery date, quality of materials, and workmanship, are all guaranteed. If you are expecting to build now, or next year, you should get our proposal, which we will prepare quickly, cheerfully, and without cost or obligation to you.

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Deliver Steam at 350 lbs. Pressure—700° F. . . . in unique Engineering Project

The pipes are weather-proofed by asphalt-saturated, close-weave, rag felt with mica surface held in place by galvanized iron wire.

From the power plant, the steam starts on its journey through 4900 feet of 14" pipe to The Champion Paper and Fibre Company's plant on the Houston ship channel.

Through forests . . . over bayous . . . above swamps and highways . . . a 4900 ft. pipe line carries its cargo of steam to the Champion Paper & Fibre Company's plant, on the Houston, Texas, ship channel.

The project consists of a 14-inch line for steam; a 4-inch return line for condensate. The steam line is insulated with 1½ inches of Carey Hi-Temp and 2 inches of Carey 85% Magnesia; the 4-inch line with 2 inches of 85% Magnesia.

Due to the high efficiency of Carey Insulations, the steam, which leaves the generating plant at 350 lbs. pressure, reaches the paper mill with an average pressure drop of only 6 lbs.

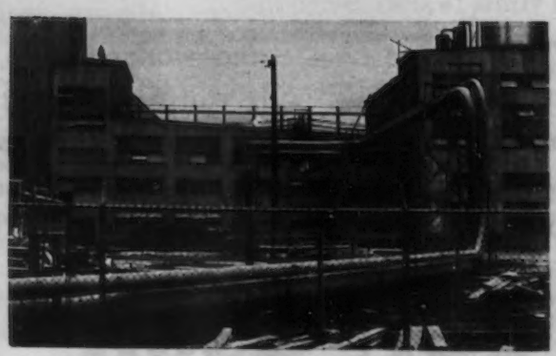
Engineers, and others interested in the transmission of steam, find that Carey Heat Insulations help to solve many problems which otherwise would be impractical. The benefits of Carey experience, covering over a half century, are available through a nationwide organization. Write for copy of Carey Insulation Handbook — address, Dept. 26.

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio

Dependable Products Since 1873

BRANCHES IN PRINCIPAL CITIES

Above highways and over bayous this pipe line is suspended from galvanized steel and timber frames.

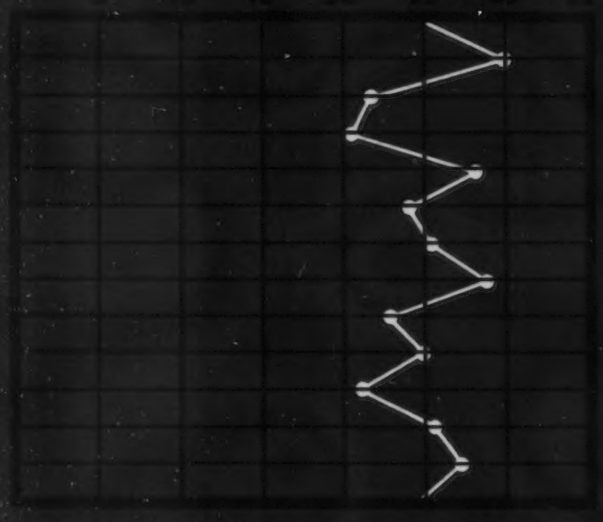


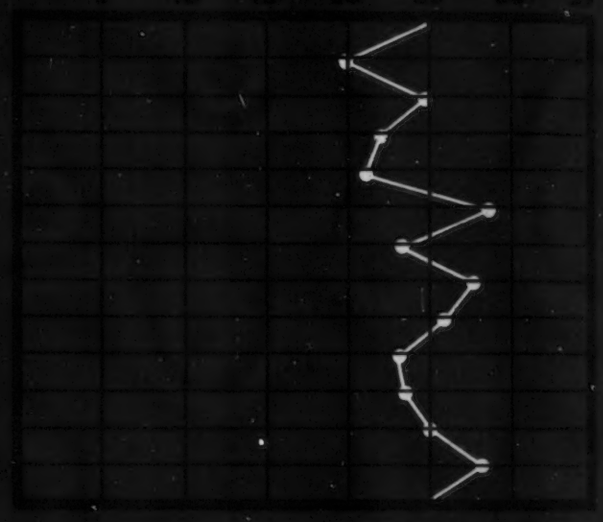
The steam is delivered through this 14 inch line, insulated by 1½ inches of Carey Hi-Temp and 2 inches of Carey 85% Magnesia.

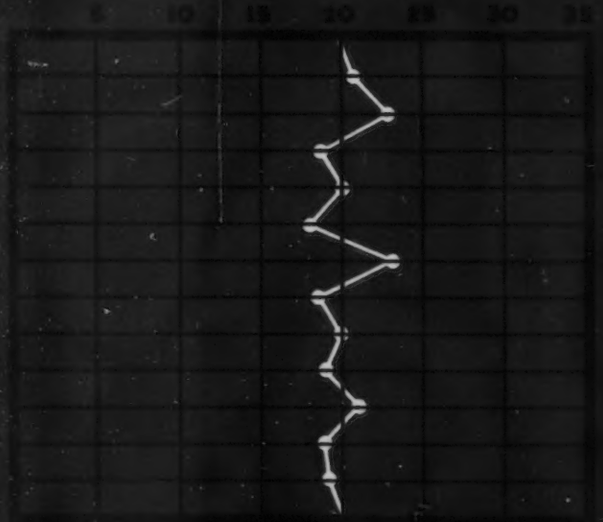
Through forests and over swamps the line winds to deliver the steam and return the condensate.

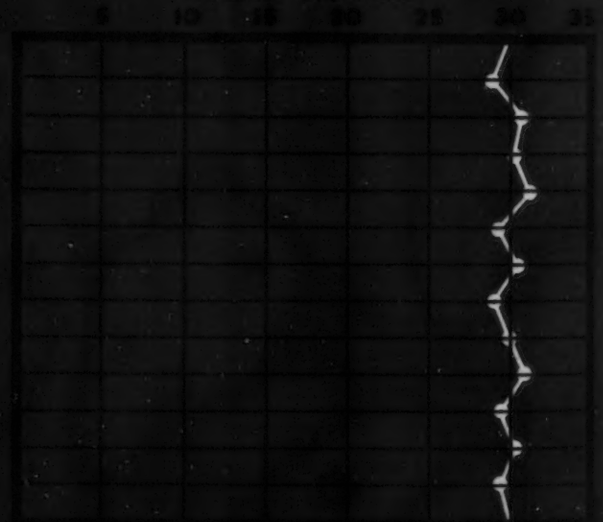
Nothing like this has ever been accomplished before. File teeth made on the principle of controlled serrations. Notice the irregular top edges of the tooth points. That's the secret of an outstanding file success.
"CONTROLLED SERRATIONS"
MADE IN THESE BRANDS
NICHOLSON
BLACK DIAMOND
McCAFFREY
A FILE FOR EVERY PURPOSE

WHAT ARE THE RESULTS
ARE MATCHED AGAINST









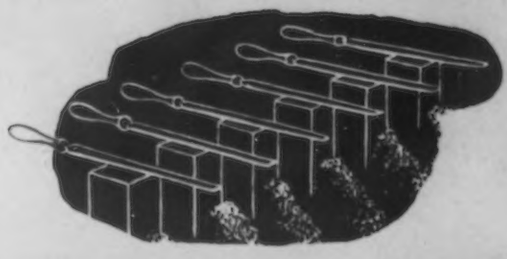
TEST CONDITIONS

KEY TO CHARTS

WHEN OLD STYLE FILES CONTROLLED SERRATIONS

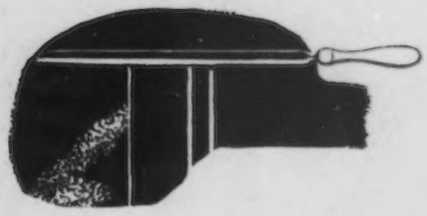
LET CHARTS TELL YOU A STORY OF GREATER ABILITY TO REMOVE STOCK . . . . MORE UNIFORM PERFORMANCE LOWER FILE COSTS

Here's what happened when our files were matched against other files—here's how controlled serrations won over other types of construction.



UNIFORM PERFORMANCE

Notice how the zig-zag line charting the performance of our files hugs the line of absolute uniformity; how lines charting other files break away from it.



ABILITY TO REMOVE STOCK

Our files completed 30 units of work against 25.0, 23.6, and 20.5 units for other brands.

LOWER FILE COSTS

"A" another brand, cost 20.1% more to use than our files

"B" another brand, cost 27.6% more to use than our files

"C" another brand, cost 46.9% more to use than our files

CONTROLLED SERRATIONS WIN

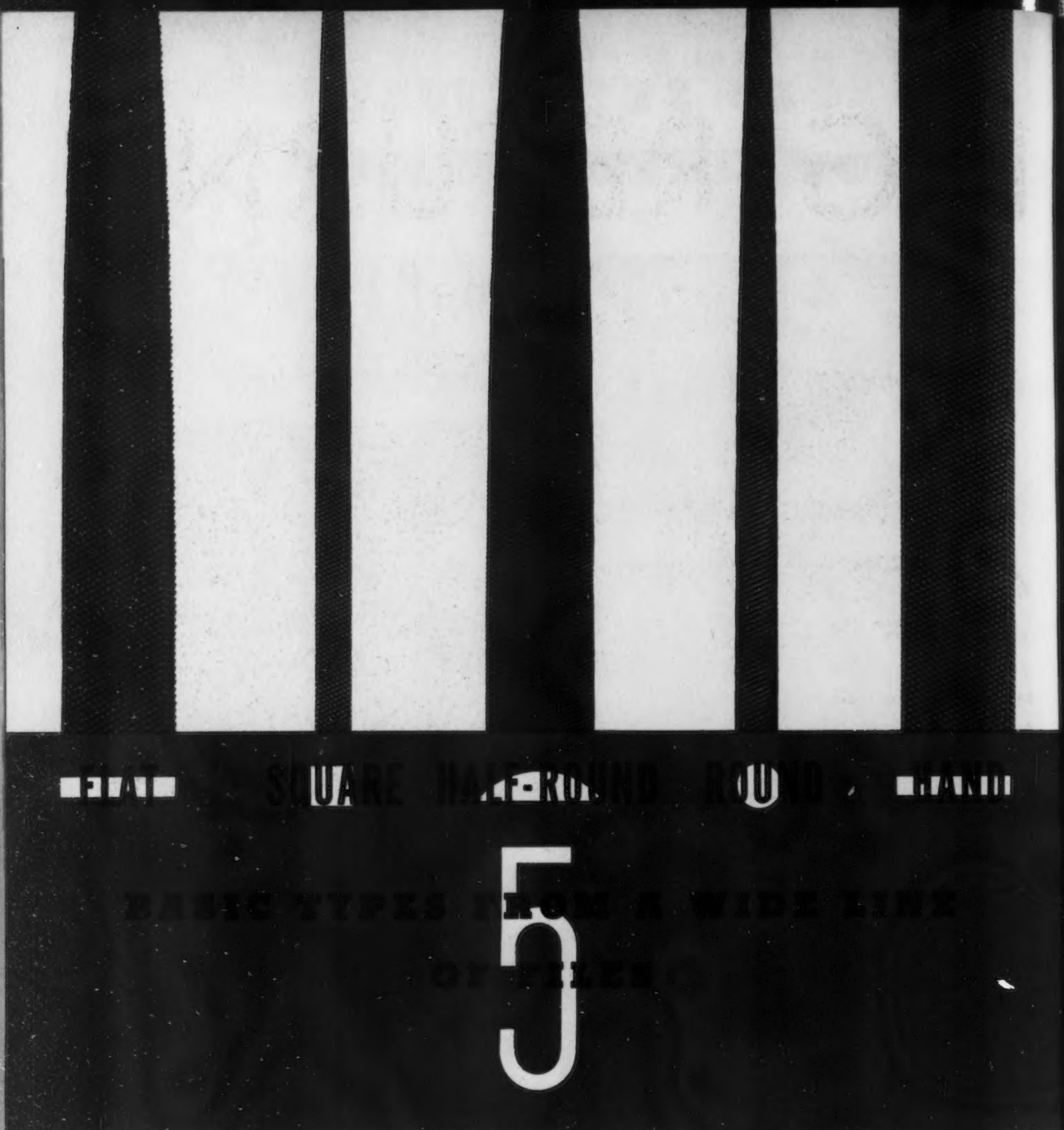
MADE IN THESE BRANDS

NICHOLSON

BLACK ◇ DIAMOND

McCAFFREY

PATENTS PENDING



Flat... Square... Half Round... Round and Hand... these five types of Nicholson, Black Diamond and McCaffrey Files are constantly used by mechanics in practically every industrial plant.

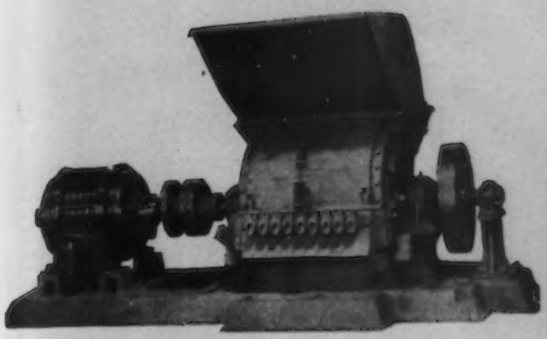
The five types illustrated are part of a great line of files — a line to which new tooth construction and high manufacturing standards bring outstanding efficiency.

Check your supply of files. See that your file equipment is well rounded. Your mill supply dealer or hardware wholesaler can meet your needs.

A FILE FOR EVERY PURPOSE

BIG RETURNS

on A Small Investment



No. 3800 American Steel Turnings Crusher with hopper mounted on bed plate. (Patented)

Feed Platform with Steel Turnings

Many shops and manufacturing plants are making extra profits by crushing their turnings into chips with AMERICAN RING STEEL TURNING CRUSHERS. Chips not only bring a higher price but are easier to handle, require less storage space and are easier to ship.

Your long turnings will cease to be a nuisance after you put an AMERICAN RING CRUSHER on the job. It will pay for itself in a very short time after which it will pay you a steady profit.

Do you want this EXTRA profit?

Write us for full particulars.

American Ring Crushers are crushing run of mine coal to stoker size at maintenance cost as low as 1/10 of a cent a ton.

We manufacture a complete line of reduction equipment. Put your problems up to us.

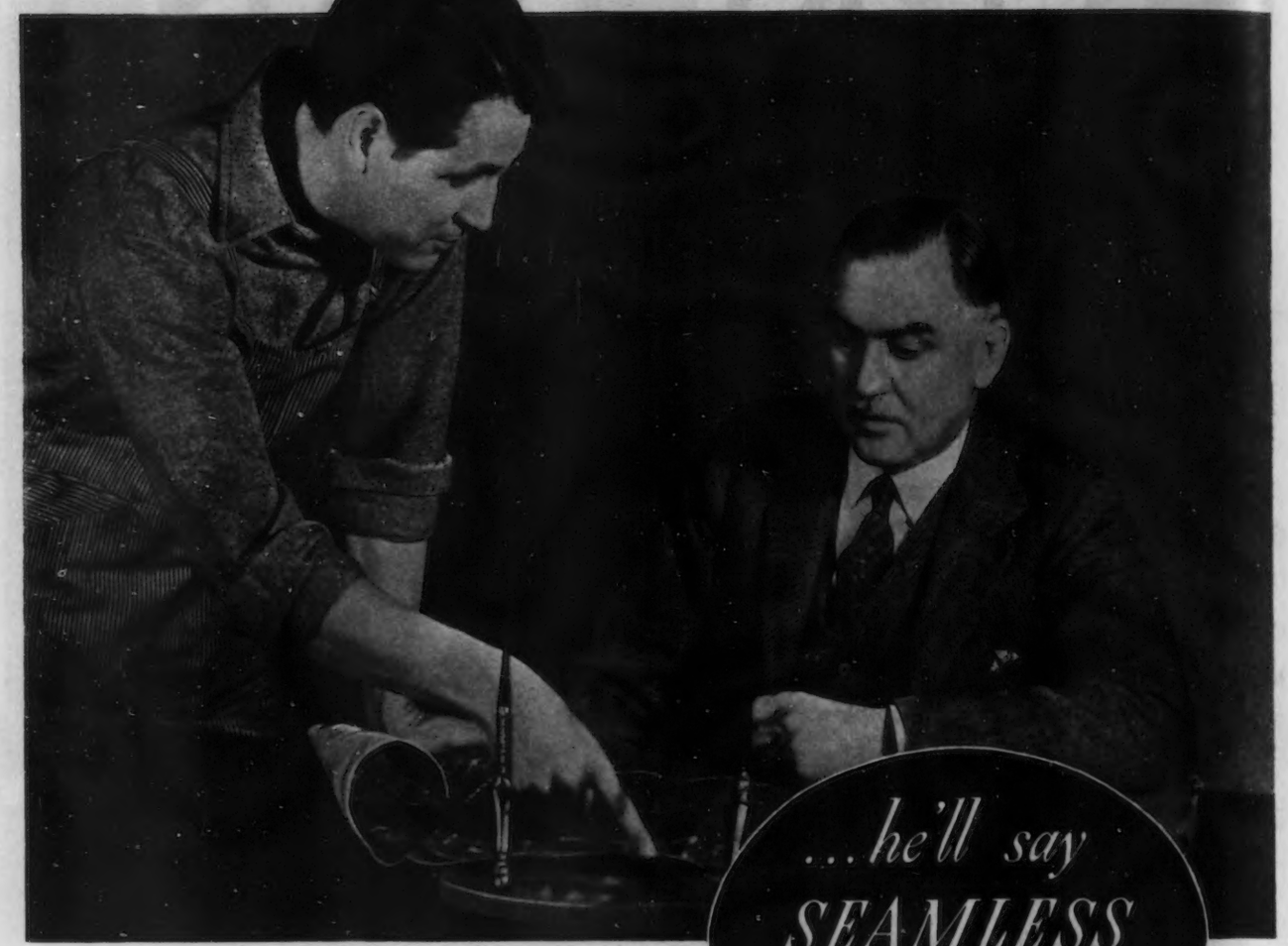
A Typical Installation

ORIGINATORS OF THE ROLLING RING CRUSHER PRINCIPLE

AMERICAN PULVERIZER COMPANY

1439 Macklind Ave., St. Louis, Mo.

ASK THE SHOPMAN...



Who should know better than the shopman—he does the actual work of installation, makes repairs, sees at first hand the devastating effect of *failure*. Ask any shopman and you'll find he prefers SEAMLESS. He knows from experience that any comparison of seamless with any other tubing is greatly in favor of seamless. Because PITTSBURGH seamless tubes are made of better, stronger steel, treated for easy rolling-in and other manipulation, they are easily installed. Because they are made of a single homogeneous piece of steel, they have no points or zones of potential weakness. Pittsburgh Steel Company's exacting system of inspection-control assures the delivery of uniformly perfect tubes. You can specify PITTSBURGH Seamless with complete confidence that you have selected the *best*.

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Stocks carried by distributors in principal cities

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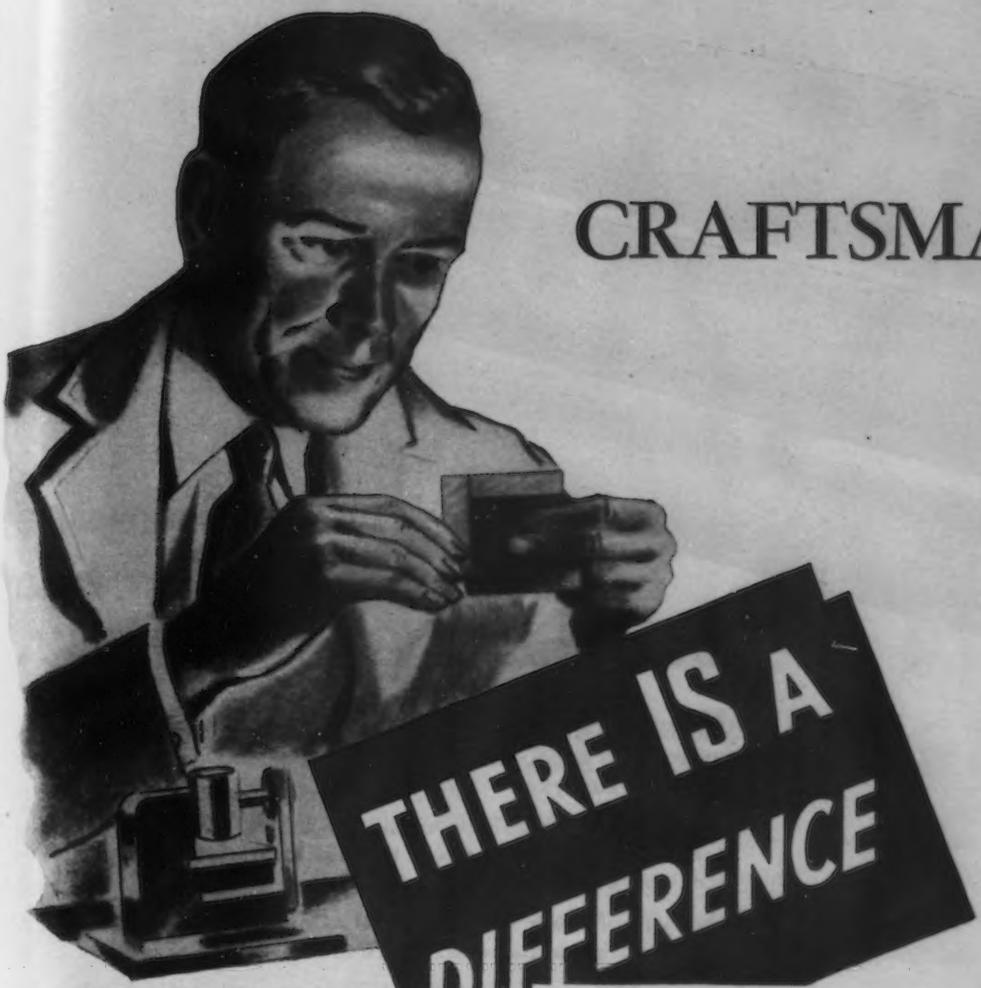
HIGH PRESSURE PIPING

THERE IS NOTHING SUPERIOR TO SEAMLESS



CRAFTSMANSHIP

THERE IS A DIFFERENCE

Augmented by years of tool-making experience, Morse craftsmanship sets standards of inspection, of grinding and heat-treating that puts "extra values" into Morse Tools. So that, in shops throughout America and the world, men point to Morse efficiency, clean work, long tool life and say, "There Is A Difference."

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THE MORSE LINE INCLUDES HIGH SPEED AND CARBON DRILLS - REAMERS - CUTTERS - TAPS and DIES - SCREW PLATES - ARBORS - CHUCKS - COUNTERBORES - MANDRELS - TAPER PINS - SOCKETS - SLEEVES

The Difference Between a Good Bronze Bar and a Better One . . .

BUNTING BARS are made of Bearing Bronze. The metallic structure is superior. The grain is fine and uniform. The bar machines easily.

Scientifically controlled, absolutely standardized foundry practice assures the maximum of the desired physical properties in each and every bar.

The bore of every Bunting Quality Cored Bar is absolutely concentric with the diameter. There are no off-center holes.

The smooth cast bore is far more satisfactory and easier to machine than a hard, glazed, broached bore. For that reason Bunting Cored Bars are not broached nor given any treatment that hardens or glazes the bore.

Bunting Bars are 13" long so that they can be cut to standard bearing lengths without the excessive waste often entailed by a shorter length.

The Machined and Centered Bunting Bar can be set true in a universal chuck in a moment, saving about 50% of set-up and machining time, and approximately 25% of purchased weight as compared with rough cast "sticks."

The next time you need Bearing Bronze Metal ask your mill supply wholesaler for Bunting Quality Bars. 131 sizes always in stock . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Branches and Warehouses in All Principal Cities.

◆ Write for catalog of Bunting Bars and Bunting Standardized Ready-For-Assembly Bearings for all mechanical and electric motor applications.

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MACHINED AND CENTERED BRONZE BARS
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Because of their well balanced design, Century Integral Horse Power General Purpose Squirrel Cage Motors are best suited to satisfactorily drive a high percentage of all motorized equipment and machinery . . .

1. No one characteristic has been overdeveloped at the expense of another.

2. They are built to accurate and precise tolerances which maintain smooth operation for accurate machine tool production.

3. Their mechanical strength enables them to withstand shock and severe fluctuating loads, without distortion.

4. Phosphor bronze bearings are proportioned to successfully withstand vibrations of such drives as spur gear and sprocket.

5. They are easy to keep clean outside, because the frames are smoothly contoured . . . Important where external cleanliness is desirable.

6. They keep themselves clean inside, in the presence of dust that will not harden with heat nor solidify with humidity.

Century Squirrel Cage Motors are furnished in Open, Splash Proof or Totally Enclosed construction . . . . Also in Multispeed Types.

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Century MOTORS

SIZES UP TO 600 HORSE POWER

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TURNED, GROUND AND POLISHED SHAFTING
ROUNDS — HEXAGONS — SQUARES — FLATS

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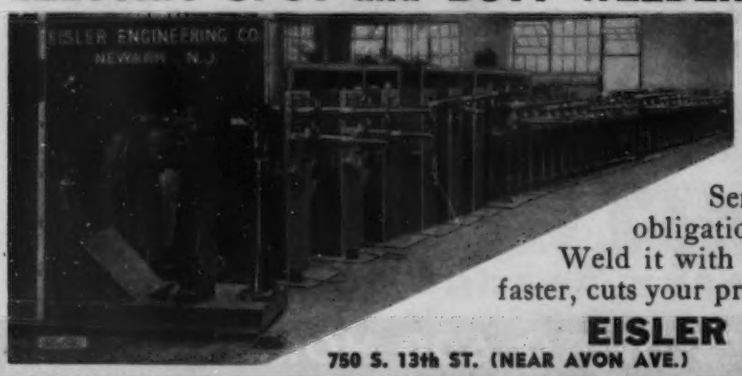

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✓WEAR RESISTANCE
✓TENSILE STRENGTH
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PERHAPS you feel you know Ampco Metal . . since it has become an increasingly important factor in the nonferrous field during the last twenty years . . or, perhaps, you just accept it as a bronze alloy possessed of an unusually stubborn resistance to wear.

But, actually, the versatility of Ampco Metal will amaze you . . for we, ourselves, as the producers of Ampco, are often genuinely surprised at its extraordinarily wide range of application. Time and again Ampco Metal has proved its versatility in a wide variety of adaptations, ranging from cams, shifters, nuts, gears, bushings and bearings, to forming and drawing dies and acid resistant equipment. Time and again it has proved not only that it can outlast other bronzes in difficult services, but also that it can actually outwear hardened steel.

In some one of its six grades Ampco Metal can probably lick a problem for you . . why not check with us?

AMPCO METAL, INC.
DEPT. IR-1014, MILWAUKEE, WIS.

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NOTE: Grade 18 is adaptable to a wide range of application; but its prime fields of service are gears, warm wheels, heavy bearings and acid resistant equipment.

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Yield Point (lbs. per sq. in.) 33,000-42,000
Elongation % in 2 inches 10-14
Red. of Area % in 2 inches

Brinell Hardness 3000 kg. load 167-179
Rockwell Hardness 85-87-B
Scleroscope Hardness 26-28
Young's Modulus 14,350,000
Charpy Impact Value 17.4

Mean Analysis
% Copper 84.60
% Aluminum 11.30
% Iron 3.70
% Special Agent 0.40
Weight lbs. per cubic inch .270

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"The Metal without an Equal"

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Pillow Blocks • Flange Units • Takeup Units
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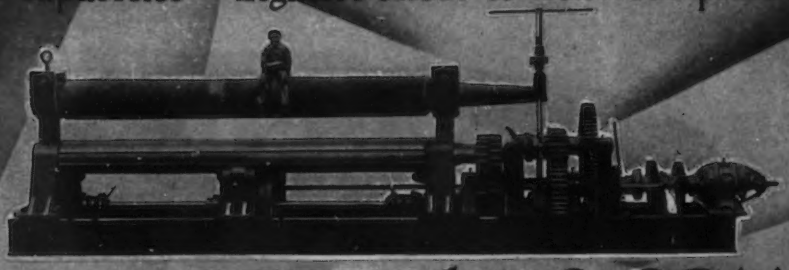
SHAFER

Everything You Need in a Roller Bearing

PLATE BENDING ROLLS

Capacities ~ Lightest sheet to heaviest plate



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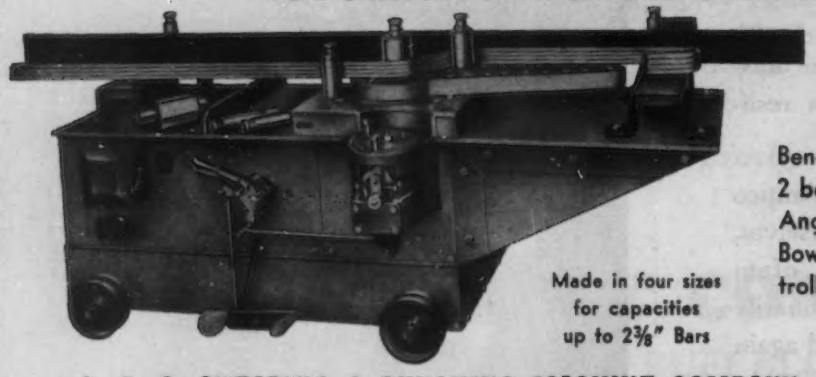
Cambridge City Indiana

AUTOMATIC MOTOR DRIVEN BENDING MACHINE FOR BENDING REINFORCING BARS



Made in four sizes for capacities up to 2⅜" Bars

Bends one or more bars at a time and makes 2 bendings simultaneously—Bends Hooks, and Angles on Truss Bars, Stirrups Rings, Spirals, Bows, etc. All bending automatically controlled. Cuts production costs.

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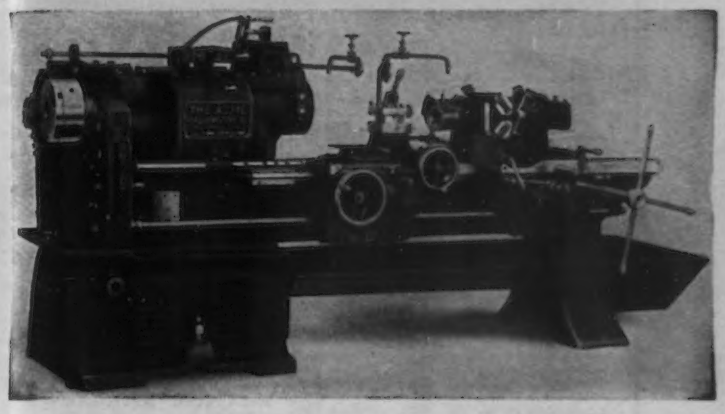
OTTO K. EITEL, *Managing Director*

Room, with Bath, from $3

This issue is dedicated to the 1937 National Metal Exposition. Among all the publications, more advertisers selected The Iron Age in which to feature their products.



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A BIG LABOR SAVER

Combines a Centerless Feed Polishing Machine — a Vertical or Horizontal Belt Grinder, Surfacer or Polisher — and an Internal Grinder or Polisher.

Suitable for any metal, rubber, fibre, molded composition, wood or other material that can be ground or polished. Automatic centerless feed swings out of way when not needed. Tracking device and automatic take-up on belt. Quickly changed from vertical to horizontal belt position for hand surfacing. Taper spindle for internal work. Ball Bearings. Direct motor drive. Use with Production belts.

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Rely on Abbott for steel balls in precision and commercial tolerances.

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Metals and the basic tools of industry with which to work them are on parade in great number in this issue.

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Seligman, Arthur, & Co., Inc., 30 Rockefeller Plaza, R. C. A. Bldg., N. Y. C.

AMMETERS AND VOLTMETERS—Recording
Leeds & Northrup Co., Philadelphia.

AMMONIA RECOVERY PLANTS
Koppers Co., Pittsburgh.

ANGLES, BEAMS, CHANNELS AND TEES
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Ryerson, Jos. T., & Son, Inc., Chicago.
Scully Steel Products Co. (U. S. Steel Corp. Subsidiary), Chicago
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.
Weirton (W. Va.) Steel Co.

ANGLES, BEAMS, CHANNELS & TEES —Magnesium Alloys
Dow Chemical Co., The, 921 Jefferson Ave., Midland, Mich.

ANNEALING—See Heat Treating

ANNEALING BOXES
Lebanon (Pa.) Steel Foundry.
United Engineering & Fdry. Co., Ptgh.

ANNEALING COVERS
Surface Combustion Corp., 2375 Dorr St., Toledo.
Wilson, Lee Engineering Co., The, Cleveland.

ANODES—All Types
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.
Seymour (Conn.) Mfg. Co.
Udylite Co., The, Detroit.

ANODES—Cadmium
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.
Udylite Co., The, Detroit.

APPAREL—Welding
Lincoln Electric Co., The, Cleveland.

ARBORS
Cincinnati (Ohio) Milling Mch. Co., The.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

ARMORING MACHINERY—Cable, Wire, Hose
Sleeper & Hartley, Inc., Worcester, Mass.

ARRESTERS—Spark
Harrington & King Perforating Co., Chicago.

ASBESTOS
Carey, Philip, Co., The, Cincinnati.

AXLES—Car or Locomotive
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.

BABBITT METALS
Cadman, A. W., Mfg. Co., Pittsburgh, Pa.

BALANCING MACHINES — Static Dynamic
Gisholt Machine Co., Madison, Wis.
Olsen, Tinius Testing Machine Co., Philadelphia.

BALING PRESSES—Scrap — See Presses —Baling

BALLS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Hartford (Conn.) Steel Ball Co., The.

BALLS—Steel, Brass or Bronze
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Hartford (Conn.) Steel Ball Co., The.
New Departure Div., General Motors Corp., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.

BANDS—Steel
Acme Steel Co., Chicago.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BANDS—Welded
Amer. Welding & Mfg. Co., Warren, O.

BARRELS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Ransohoff, N., Inc., Cincinnati.

BARRELS—Tumbling
Baird Mch. Co., The, Bridgeport, Conn.
Hartford (Conn.) Steel Ball Co., The.
Ransohoff, N., Inc., Cincinnati.
Whiting Corp., Harvey, Ill.

BARS—Alloy
Republic Steel Corp., Cleveland, Ohio.

BARS—Aluminum
Aluminum Co. of America, Pittsburgh.

BARS—Brass, Bronze or Copper
Bunting Brass & Bronze Co., Toledo, Ohio.
Johnson Bronze Co., 505 So. Mill St., New Castle, Pa.

BARS—Cold Drawn
American Steel & Wire Co. (U. S. Steel Corp. Subsidiary), Chicago.
Bliss & Laughlin, Inc., Harvey, Ill.
Union Drawn Steel Co., Massillon, Ohio.

BARS—Concrete, Reinforcing
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Jones & Laughlin Steel Corp., Pittsburgh.
Laclede Steel Co., St. Louis, Mo.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BARS—Flux
St-Lux Co., Pittsburgh.

BARS—Magnesium Alloys
Dow Chemical Co., The, 921 Jefferson Ave., Midland, Mich.

BARS—Rustless
Rustless Iron & Steel Corp., Baltimore, Md.

BARS—Steel
Ames, W., & Co., Jersey City, N. J.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Great Lakes Steel Corp., Detroit.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Republic Steel Corp., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Scully Steel Products Co. (U. S. Steel Corp. Subsidiary), Chicago.
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co., The.

BATTERIES—Storage
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USL Battery Corp., Niagara Falls, N. Y.

BATTERY CHARGERS
Cutler-Hammer, Inc., Milwaukee.

BEAMS—See Angles, Beams, Channels and Tees

BEARINGS—Babbitt
Cadman, A. W., Mfg. Co., Pittsburgh, Pa.
Johnson Bronze Co., 505 So. Mill St., New Castle, Pa.

BEARINGS—Ball
Bantam Bearings Corp., The, South Bend, Indiana.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., Poughkeepsie, N. Y.

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BEARINGS, Brass and Bronze
Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., 505 So. Mill St., New Castle, Pa.
Lawrenceville Bronze Co., Pittsburgh.
National Bearing Metals Corp., Pittsburgh.

BEARINGS—Oilless
Bunting Brass & Bronze Co., Toledo, O.
Rhoades, R. W., Metaline Co., Inc., Long Island City, N. Y.
Richardson Co., The, Melrose Park, Ill.

BEARINGS—Quill
Bantam Bearings Corp., The, South Bend, Indiana.

BEARINGS—Radial
Bantam Bearings Corp., The, South Bend, Indiana.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
Hyatt Bearings Div., General Motors Corp., Newark, N. J.
New Departure Div., General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
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Shafer Bearing Corp., 35 East Wacker Drive, Chicago.

BEARINGS—Roll Neck
Bantam Bearings Corp., The, South Bend, Indiana.
Morgan Construction Co., Worcester, Mass.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Shafer Bearing Corp., 35 East Wacker Drive, Chicago.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Roller
Bantam Bearings Corp., The, South Bend, Indiana.
Hyatt Bearings Div., General Motors Corp., Newark, N. J.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Shafer Bearing Corp., 35 East Wacker Drive, Chicago.
Standard Machinery Co., Providence, R. I.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Roller Tapered
Bantam Bearings Corp., The, South Bend, Indiana.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Rolling Mill Equipment
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Richardson Co., The, Melrose Park, Ill.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Self-aligning Roller
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BEARINGS—Shaft Hanger
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Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Shafer Bearing Corp., 35 East Wacker Drive, Chicago.

BEARINGS—Thrust
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Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
Hyatt Bearings Div., General Motors Corp., Newark, N. J.
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Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
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Shafer Bearing Corp., 35 East Wacker Drive, Chicago.
Timken Roller Bearing Co., The, Canton, O.

BELT DRESSING
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BELT LACING
Rhoads, J. E., & Sons, Philadelphia.

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BELTING CEMENT
Rhoads, J. E., & Sons, Philadelphia.

BELTING—Leather
Chicago (Ill.) Rawhide Mfg. Co., The, 1306 Elston Ave.
Rhoads, J. E., & Sons, Philadelphia.

BELTING—Metal, Conveyor, High and Low Temperature
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Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

BELTING—Rubber
Goodrich, B. F., Co., The, Akron, Ohio.
Goodyear Tire & Rubber Co., Akron, Ohio.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.
Robins Conveying Belt Co., 15 Park Row, N. Y. C.

BELTS—V-Type
Allis-Chalmers Mfg. Co., Milwaukee.
Goodyear Tire & Rubber Co., Akron, Ohio.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

BENDING MACHINES—Hand, Band and Angle
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BENDING MACHINES—Hand and Power
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Dreis & Krump Mfg. Co., Chicago.
G. D. S. Shearing & Punching Machine Co., 101 Walker St., N. Y. C.
Kane & Roach, Inc., Syracuse, New York.
Niagara Machine & Tool Works, Buffalo, N. Y.

BENZOL RECOVERY PLANTS
Koppers Co., Pittsburgh.

BERYLLIUM COPPER
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BILLETS—Alloy Steel
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BILLETS—Carbon Steel
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BILLETS—Carbon Vanadium Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Chrome Nickel Steel
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Rustless Iron & Steel Corp., Baltimore, Md.

BILLETS—Chrome Steel
Andrews Steel Co., The, Newport, Ky.
Rustless Iron & Steel Corp., Baltimore, Md.

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Republic Steel Corp., Cleveland, Ohio.

BILLETS—Nickel Steel
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BILLETS—Steel
Bethelhem (Pa.) Steel Company.
Continental Steel Corp., Kokomo, Ind.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BIMETAL—Thermostatic
Chace, W. M., Co., 1605 Beard Ave., Detroit.

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Frick-Gallagher Mfg. Co., The, Wellston, Ohio.

BLANKS—Chisel
Cleveland Steel Tool Co., The, 660 E. 92nd St., Cleveland, Ohio.

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Chicago (Ill.) Rawhide Mfg. Co., The, 1306 Elston Ave.
Richardson Co., The, Melrose Park, Ill.

BLANKS—Gear, Silent Steel
Waldron, John, Corp., New Brunswick, N. J.

BLAST CLEANING EQUIPMENT
American Foundry Equipment Co., The, 401 Byrkit St., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.

BLAST FURNACES
Brassert, H. A., & Co., Chicago, Ill.

BLAST GATES
Rockwell, W. S., Co., 50 Church St., N.Y.C.

BLOCKS—Chain
Yale & Towne Mfg. Co., The, Phila. Div., Phila., Pa.

BLOCKS—Set-Up, For Machine Tools
Standard Shop Equipment Co., Philadelphia.

BLOWERS
American Air Filter Co., Inc., Louisville, Ky.
American Blower Corp., 6000 Russell St., Detroit.
Ingersoll-Rand Co., 11 Broadway, N. Y. C.
North American Mfg. Co., The, Cleveland.
Spencer Turbine Co., Hartford, Conn.

BLOWPIPES—Oxy-Acetylene Welding & Cutting
Linde Air Prods. Co., The, 30 E. 42nd St., N. Y. C.
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BLOWPIPES — Soldering, Heating, Annealing
American Gas Furnace Co., Elizabeth, N.J.
Weldit Acetylene Co., Detroit.

BOILER HEADS—Flanged & Dished
Commercial Shearing & Stamping Co., Youngstown, Ohio.

BOILERS
Munroe R., & Sons Mfg. Corp., Pittsburgh.

BOILERS—Waste Heat
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BOILERS—Water Tube
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BOLT CUTTERS
Acme Machinery Co., Cleveland.
Landis Mch. Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland.
Ajax Mfg. Co., The, Euclid, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Manville, E. J., Mch. Co., Waterbury, Ct.
National Machinery Co., Tiffin, Ohio.
Waterbury (Ct.) Farrel Fdry. & Mch. Co., The.

BOLT & RIVET CLIPPERS
Bremil Mfg Co., Erie, Pa.
Helwig Mfg. Co., St. Paul, Minn.

BOLTS—Carriage and Machine
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Erie (Pa.) Bolt & Nut Co.
Lamson & Sessions Co., The, Cleveland.
Oliver Iron & Steel Corp., Pittsburgh.
Republic Steel Corp., Upson Nut Div., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

JUST BETWEEN US TWO

Blurb

NEVER in the history of The Iron Age has a National Metal Exposition section carried as much advertising as this one—160 pages—count 'em—160. And the advertising of this plump beauty—272 pages—is, excepting Annuals, highest in gawdknowshowlong.

Hubbard's Hero's Kin Joins Iron Age

WE thought you might like to know that Jim Rowan, our new news editor and authority on labor relations, is related to Andrew Rowan, who carried the message to Garcia.

The old gentleman, a retired lieutenant-colonel, is still living, in San Francisco.

English Lesson

SOMEBODY should tell Rudy Vallee that although it sounds very Park Avenue to pronounce negotiation nee-go-see-ay-shun, the right pronunciation is nee-go-she-ay-shun.

And while we are at it we might as well remark that it may sound like high-class speakin', as Andy used to say, to slur the ultima of sacrifice and call it sak-ri-fiss, but only sak-ri-fyce or sak-ri-fyz will keep Webster from turning in his grave.

Don't Mention It

A CHILDLIKE faith in the dictum, "Never sell America short," makes us almost as unconscious of pessimistic predictions as a customer is of dinner checks. But paradoxically we always have a slight twinge whenever we see a headline like this one in a recent issue of the *New York Times:*

COUNTRY IS ON SOUND BASIS FOR RECOVERY, SAY EXPERTS

TOO much protesting activates a contrary streak in people which is normally dormant, and if the experts will resist the temptation to break into print with rosy predictions, it will be a good thing.

And Lo! The Iron Age Name Led . . .

EVERY now and then some one of the eighteen certified readers of this column complains that we talk too much about The Iron Age. Forthwith we make a good resolution, which we keep until something happens that it would be unfair to keep from you. For instance:

One of the larger and very expensive general magazines wangled a list from the Government of all those earning over $15,000 a year. To this list of big shots a questionnaire was sent, asking, "What magazines do you read?"

And what was the only industrial journal to be among the first twenty publications named? Why, your favorite family journal, of course.

We know it will astonish you as it did us to learn that "the cost per reader of reaching men earning $15,000 or more a year" is in the case of The Iron Age a measly 28c.

The Doc Does It Again

DR. FUNK, the lexicographer, has raised the right hand of the lady who submitted "neolectress" in a contest to get an up-to-date title for "housewife." Our guess is that the winner took an extra long pull on a marihuana cigarette, downed a mess of welsh rarebit, fell to sleep reading "Ulysses" and nightmared her entry.

It was Dr. Funk, you will recall, who cooked up "neologist" for the New York Evening Journal to pin on its readers. But with two strikes against him, we will spring to the doctor's defense and deny that he fathered that etymological abortion, "electragist," which attempted not so long ago to strangle innocent electrical contractors in its ugly tentacles.

The history of high-brow titles is dismal. Even "realtor," though blessed by the dictionary-makers, has not quite made the grade, and people stubbornly continue to say "plumber" instead of "sanitary engineer," and "barber" instead of "tonsorial artist." The brass hats in the trade paper field have been trying for years to do a Medici to the homely term "trade paper" and substitute the refined "business paper." But people still continue to write, *"We love your trade paper."* It is all very sad.

Stopper

33,000 Unblinking Eyes—Crane Co.

Invitation

H-16 is the number of our booth at the National Metal Exposition to be held in Atlantic City next week. It would be nice if you would visit us there. —A.H.D.

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Hotel CLARIDGE

Joseph P. Binns, Manager

ATLANTIC CITY

Products Index

BOLTS—Machine Tool Table
Standard Shop Equipment Co., Philadelphia.

BOLTS—Special
Erie (Pa.) Bolt & Nut Co.
Lamson & Sessions Co., The, Cleveland.
Oliver Iron & Steel Corp., Pittsburgh.
Republic Steel Corp., Upson Nut Div., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS—Special, Hot or Cold Upset
Lamson & Sessions Co., The, Cleveland.
Oliver Iron & Steel Corp., Pittsburgh.

BOLTS—Stove
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Lamson & Sessions Co., The, Cleveland.

BOLTS—T Slots
Standard Shop Equipment Co., Philadelphia.

BOLTS—Track
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Republic Steel Corp., Upson Nut Div., Cleveland, O.

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Ames, W., & Co., Jersey City, N. J.
Clark Bros. Bolt Co., Millidale, Conn.
Erie (Pa.) Bolt & Nut Co.
Lamson & Sessions Co., The, Cleveland.
Oliver Iron & Steel Corp., Pittsburgh.
Republic Steel Corp., Cleveland, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS AND NUTS—Self-Locking
Lamson & Sessions Co., The, Cleveland, O.

BOND—Grinding Wheel
Bakelite Corp., 247 Park Ave., N. Y. C.

BOOTHS—Spray
DeVilbiss Co., The, Toledo, Ohio.

BORING BARS
Bullard Co., The, Bridgeport, Conn.

BORING, DRILLING & MILLING MACHINES—Horizontal
Hill-Clarke Mchry. Co., 647 W. Washington Blvd., Chicago.
Lucas Machine Tool Co., Cleveland.
National Automatic Tool Co., Richmond Ind.

BORING & DRILLING MACHINES—Vertical
Baker Bros., Inc., Toledo, Ohio.
Bullard Co., The, Bridgeport, Conn.

BORING MACHINES—Diamond
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit.

BORING MACHINES—Diamond & Carbide Tools
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Cincinnati (Ohio) Planer Co.
Rogers Machine Wks., Alfred, New York.

BOX STRAPPING
Acme Steel Co., Chicago, Ill.

BRAKE LINING AND BLOCKS—Asbestos
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

BRAKES—Electric
Cutler-Hammer, Inc., Milwaukee.

BRAKES—Electric & Mechanical
Clark Controller Co., The, Cleveland.
Electric Controller & Mfg. Co., The, Cleveland.

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Dreis & Krump Mfg. Co., Chicago.
Peck, Stow & Wilcox Co., The, Southington, Conn.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Steelweld Machinery Co., Cleveland.

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BRICK—Acid Resisting
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BRICK—Fire Clay
Carborundum Co., The, Niagara Falls, N. Y.
Illinois Clay Products Co., Joliet, Ill.
Keasler Brick Co., Steubenville, Ohio.
Quigley Co., Inc., 56 West 45th St., N. Y. C.

BRICK—Insulating
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BRIDGE BUILDERS
American Bridge Co. (U. S. Steel Corp. Subsidiary), Pittsburgh.
Belmont Iron Works, Philadelphia.

BRIDGE OPERATING MACHINERY—Movable
Earle Gear & Mch. Co., Philadelphia.

BRIQUETS—Ferroalloy
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

BROACHING MACHINES
Bullard Co., The, Bridgeport, Conn.
Cincinnati (Ohio) Milling Mch. Co., The.
Oilgear Co., The, 1311 W. Bruce St., Milwaukee.

BRONZE FOR DIES
Ampco Metal, Inc., Milwaukee, Wis.

BRONZE—Phosphor
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Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.
Seymour (Conn.) Mfg. Co.

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BRUSHES—Wire
Pittsburgh Plate Glass Co., Brush Div., Baltimore, Md.

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Hayward Co., The, 50 Church St., N. Y. C.
Industrial Brownhoist Corp., Bay City, Mich.

BUCKETS—Electric Motor
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BUCKETS—Orange Peel
Hayward Co., The, 50 Church St., N. Y. C.

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Iron & Steel Products, Inc., Chicago.

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Ajax Mfg. Co., The, Euclid, Ohio.
Beatty Mch. & Mfg. Co., 936—150th St., Hammond, Ind.
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Johnson Bronze Co., 605 So. Mill St., New Castle, Pa.
Lawrenceville Bronze Co., Pittsburgh.
Phosphor Bronze Smelting Co., The, Phila.
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BUSHINGS—Phosphor Bronze
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Phosphor Bronze Smelting Co., The, Phila.

BY-PRODUCTS COKE AND GAS OVENS
Koppers Co., Pittsburgh.

CABINETS—Stock
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CABLE—Electric
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., The, Cleveland.
Simplex Wire & Cable Co., Cambridge A, Boston, Mass.

CABLEWAYS AND TRAMWAYS—See Tramways

CADMIUM
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.
Udylite Co., The, Detroit.

CADMIUM PLATING PROCESS
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.
Udylite Co., The, Detroit.

CALCIUM METAL & ALLOYS
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

CALCULATING MACHINES
Monroe Calculating Machine Co., Inc., Orange, N. J.

CARBIC
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIDE
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIDE—Boron
Norton Co., Worcester, Mass.

CARBURIZING BOXES
Electro Alloys Co., Elyria, Ohio.

CARBURIZING—See Heat Treating

CARS—Railway
Iron & Steel Products, Inc., Chicago.

CARS—Industrial and Mining
Atlas Car & Mfg. Co., The, Cleveland.
Hartlett, C. O.-Snow Co., The, Cleveland.

CASE HARDENING—See Heat Treating

CASTINGS—Acid or Heat Resisting
Ampco Metal, Inc., Milwaukee, Wis.
Duriron Co., Inc., The, 438 N. Findlay St., Dayton, Ohio.
Electro Alloys Co., Elyria, Ohio.
Hoskins Mfg. Co., Detroit, Mich.
Lebanon (Pa.) Steel Foundry.
Midvale Co., The, Nicetown, Phila., Pa.
Meehanite Metal Corp., Pittsburgh.

CASTINGS—Alloy Iron
Forging & Casting Corp., The, Ferndale, Mich.
Weatherly (Pa.) Foundry & Mfg. Co.

CASTINGS—Alloy Steel
Bissett Steel Co., The, Cleveland.
Dodge Steel Co., Philadelphia, Pa.
Electro Alloys Co., Elyria, Ohio.
Hartford (Conn.) Electric Steel Corp.
Lebanon (Pa.) Steel Foundry.
Mackintosh-Hemphill Co., Pittsburgh.
Midvale Co., The, Nicetown, Phila., Pa.
Unitcast Corp., Toledo, Ohio.